TESE DE DOUTORAMENTO

# PERIODONTAL AWARENESS, RELATED KNOWLEDGE, AND ANALYSIS OF CLINICAL COUNSELORS IN GALICIA

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# " Periodontal awareness, related knowledge, and analysis of clinical counselors in Galicia"

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**RESUMEN**
La enfermedad periodontal o periodontitis se define como una infección crónica multifactorial de etiología bacteriana asociada a la disbiosis de el biofilm bacteriano y caracterizada por la progresiva destrucción de los tejidos de soporte del diente (encía, hueso y ligamento periodontal). Mientras que la formación del biofilm bacteriano origina la inflamación gingival, conocida como gingivitis, la progresión a una peridontitis establecida se produce cuando el tejido de soporte (hueso y ligamento periodontal) se ve afectado. En la mayoría de los casos cursa de forma crónica mientras que en un pequeño porcentaje poblacional la progresión puede ser más rápida.
La periodontitis comienza con la colonización microbiana del periodonto, generalmente en personas con mala higiene oral y mediante una serie de procesos bioquímicos y la consiguiente disbiosis bacteriana, (con aumento de los periodontopatógenos) se forman las bolsas periodontales donde las bacterias activan el sistema de defensa produciéndose la pérdida de inserción. En función del grado de pérdida se establece un diagnóstico y pronóstico de la enfermedad. En sus fases avanzadas, los signos y síntomas son evidentes con inflamación y sangrado generalizado de las encías, movilidad y/o migración patológica dentaria y como consecuencia final se produce la pérdida de los mismos.
Los efectos de la periodontitis pueden ir más allá de la cavidad oral. Tras la diseminación bacteriana a través de los vasos sanguíneos y sus productos originados en el biofilm bacteriano se produce también un aumento de los mediadores inflamatorios producidos en la bolsa periodontal. Mediante esos mecanismos, la periodontitis se asocia a varias enfermedades sistémicas, especialmente la diabetes, y otras como la ateroesclerosis, la obesidad y el estrés. La relación con la diabetes ha sido muy investigada y se ha demostrado que no solo la diabetes exacerba los signos y síntomas de la periodontitis sino que también se ha visto una respuesta positiva en los niveles de glucemia sanguínea tras el tratamiento periodontal. Es por ello que las clínicas dentales deben promover el diagnostico precoz de este tipo de patologías muy asociadas con la salud periodontal.
El tabaco se considera un factor de riesgo de periodontitis agravando la pérdida ósea y enmascarando alguno de los signos patognomónicos de la periodontitis como son la inflamación y el sangrado gingival. En pacientes fumadores la respuesta al tratamiento periodontal es menos predecible y por lo tanto el riesgo de progresión de la enfermedad es mayor.
**Antecedentes**
La prevención es el pilar más importante en todo paciente de riesgo y es por ello que una visita anual facilitaría un diagnóstico precoz de la enfermedad periodontal, lo cual evitaría una progresión a estadíos mas avanzados con peor pronóstico. En España se estima que tan solo un 15% de entre 35-44 años presenta unas encías sanas, mientras que el resto tiene algún tipo de patología periodontal. En personas mayores de 65 años únicamente el 10% tiene las encías sanas.
Una condición necesaria para el diagnóstico de cualquier enfermedad es que el paciente acuda a una revisión, y para ello, el paciente ha de reconocer los signos y

síntomas como una alteración de la salud. En el caso particular de la periodontitis, el sangrado gingival es normalmente el único signo evidente, hasta que en los estadíos más avanzados los signos son mas evidentes con movilidad dentaria y migración patológica. El principal inconveniente de la periodontitis es el diagnóstico tardío, lo cual requiere tratamientos más complejos y empeora el pronóstico de los dientes. El diagnóstico precoz es la manera más eficaz de reducir la pérdida dentaria evitando alteraciones masticatorias y estéticas así como reduciendo los costes económicos. Esta falta de alerta de los principales signos de la periodontitis y el hecho de que estos son comunes a gran parte de la población, e indoloros, dificulta un diagnóstico en sus fases iniciales. Se han realizado estudios analizando los efectos de intervenciones poblacionales para aumentar la alerta periodontal con resultados positivos, que sin embargo no se mantienen a lo largo del tiempo.

Las actitudes positivas con los hábitos de higiene oral parecen estar directamente influidas por el conocimiento previo de la enfermedad. Por lo tanto, una condición previa debe ser la difusión del conocimiento por los distintos transmisores de salud (médicos, enfermeras y odontólogos) con el objetivo de mejorar la salud periodontal de la población y reducir su alta prevalencia. Un nivel bajo en el conocimiento de la enfermedad periodontal parece tener un efecto directo en la higiene oral y en la identificación de los síntomas como patológicos, junto con la falsa creencia de que la pérdida de dientes es una consecuencia directa del envejecimiento.

El nivel socioeconómico de la población y el acceso a servicios sanitarios también se ha visto que afecta a la prevalencia de la periodontitis.

Con la información obtenida de estudios previos se observó la necesidad de examinar si los déficits en el conocimiento de la enfermedad periodontal son o no comunes a toda la población, así como de definir los principales déficits en el conocimiento de la misma.

Ante la ausencia de información en nuestro entorno (sur de Europa), se diseñó un estudio transversal para evaluar el grado de conocimiento en la población gallega y si afecta por igual a toda la población, o si es posible identificar grupos poblacionales considerados de “riesgo”.

Teniendo en cuenta que el primer contacto con el sistema sanitario público en Galicia es habitualmente el médico de familia y las enfermeras (el 84,4% visitó a su medico en 2018 frente al 40,5% visitó a su dentista), consideramos de vital importancia evaluar el grado de conocimiento de los principales transmisores de información en salud en el sistema sanitario gallego.

Por otra parte, se presupone que las clínicas dentales son el mejor lugar para la educación en salud periodontal. Sin embargo, no hay información en nuestro entorno de cómo afectan las visitas al dentista en el nivel de conocimiento de la enfermedad periodontal en los pacientes.

**Metodología**

La revisión sistemática se diseñó siguiendo los requisitos recogidos en la guía PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) y fue registrada en PROSPERO (International Prospective Register of Systematic Reviews). Se evaluaron únicamente estudios transversales, dirigidos a la población

general y adulta (>18 años), publicados en los siguientes idiomas: ingles, francés, alemán, italiano, portugués y español, excluyéndose estudios con muestras de conveniencia o dirigidos a sectores de la población con un conocimiento de la salud presumiblemente mayor.

La búsqueda se realizó utilizando las bases de datos PubMed, EMBASE, y SciELo, seleccionando artículos publicados en el período 1998-2014, combinada con una búsqueda manual en la red de bibliotecas de las universidades gallegas. La estrategia de búsqueda fue la siguiente: "periodontitis OR periodontal disease" and "knowledge OR awareness".

Dos revisores independientes llevaron a cabo la búsqueda avanzada (PDI y PVC), y pusieron en común la búsqueda obtenida. Se eligieron los artículos por consenso y un tercer revisor participó cuando no había acuerdo.

Tras evaluar el riesgo de sesgo (alto/bajo) de los artículos, se llevó a cabo un análisis crítico. La variable principal (conocimiento de la enfermedad periodontal) fue evaluada mediante la relación de respuestas correctas/incorrectas para cada cuestión en cada estudio. Las variables secundarias (dimensiones de la periodontitis) fueron definidas mediante la combinación de respuestas incorrectas para cada ítem relacionado con cada una de las siguientes dimensiones: alerta, etiología, riesgos asociados, signos y síntomas, factores de riesgo, tratamiento, conocimiento general, prevención y actitudes.

Tras evaluar las lagunas de conocimiento de la enfermedad periodontal a nivel global y ver la ausencia de información en nuestro entorno, se diseñaron tres estudios transversales con un instrumento común (cuestionario) y con una metodología similar entre ambos. Los tres estudios se realizaron en Galicia, y el trabajo de campo tuvo lugar en distintas fases: de Marzo 2015-Junio 2016 y de Octubre 2016- Diciembre 2016. El estudio fue aprobado por el Comité de Ética Santiago-Lugo dependiente de la Xunta de Galicia y registrado con el código #2014/600.

El cuestionario fue desarrollado por un grupo de expertos con los ítems más relevantes obtenidos de la revisión sistemática, y el cuestionario fue pilotado en un grupo de 10 alumnos de Odontología y en 97 personas adultas (la mayoría >65 años) con el objetivo de evaluar la comprensión y utilidad del mismo.

En total, 12 personas llevaron a cabo las entrevistas, 4 de ellos eran estudiantes de Odontología en su último año mientras que el resto ya habían completado sus estudios universitarios.

En el desarrollo del cuestionario, los participantes debían enumerar las enfermedades orales que conocían. Si mencionaban el término enfermedad periodontal/periodontitis/piorrea se les consideraba en el grupo "muy conscientes (very aware)". Si no lo mencionaban, se les preguntaba si habían oído hablar acerca de la periodontitis/piorrea. Si la respuesta era afirmativa se les consideraba en el grupo "consciente (aware)", y si no conocían la patología se les daba una definición general de la misma y se les agradecía su participación ("no conscientes" (not aware)). Los participantes de los grupos "muy conscientes" y "conscientes" se desarrollaba el cuestionario al completo.

**Resultados**

Con respecto a la revisión sistemática, participaron un total de 7945 participantes en los distintos estudios y la distribución geográfica fue la siguiente: Europa, Asia y Oceanía. Todos mostraron un bajo riesgo de sesgo excepto en el estudio de Nueva Zelanda, con un riesgo de sesgo elevado. Se obtuvieron datos crudos de las preguntas realizadas, y fueron incluidas en cada una de las nueve dimensiones del conocimiento. El mayor déficit de conocimiento obtenido fue en el ítem de la "alerta" (80%), seguido por la "etiología" (75%) y los "riesgos relacionados" en tercer lugar (71,43%).

La importancia relativa de las lagunas de conocimiento volvió a demostrar que la "alerta" y la "etiología" eran los campos donde se requieren intervenciones educativas, y también demostró un pobre conocimiento de la relación enfermedad periodontal-enfermedades sistémicas.

En cuanto al primer estudio transversal, un total de 8206 personas fueron invitadas a participar y 3553 aceptaron la invitación (43,3%). La mayoría de los participantes fueron considerados "muy conscientes" (62,1%), mientras que más de un tercio no conocían la existencia de la enfermedad periodontal (37,9%); el 19,4% fue considerado "muy consciente" al enumerar entre las principales enfermedades de la cavidad oral la periodontitis y/o piorrea.

En el grupo "muy consciente" hubo un mayor porcentaje de mujeres y universitarios (18-34 años).

Se observaron lagunas en el conocimiento en el grupo considerado de mayor alerta. Estos "gaps" fueron encontrados en todos los ámbitos de la enfermedad periodontal excepto en la prevención y el tratamiento, para este grupo en concreto.

Con el objetivo de conocer el grado de conocimiento en aquellos participantes que podrían padecer la enfermedad se les pregunto: "¿Le sangran las encías?" y "¿Se le mueve algún diente?". El 8,2% de los participantes respondieron afirmativamente a ambas preguntas. Se observó que este grupo de participantes eran de edad avanzada (>65 años), con menos estudios y con historial de fumar o haber fumado significativamente mayor que los correspondientes participantes "periodontalmente sanos" y "muy conscientes".

El segundo estudio de esta Tesis, enfocado en dilucidar el grado de conocimiento en profesionales sanitarios consistió en un total de 2375 invitados y un total de 1461 participantes con un porcentaje de respuesta del 61,5%.

De los participantes, el 4% del subgrupo de población general conocía la etiología bacteriana, frente al 16% de enfermeras y el 34% de los médicos.

El 44% de la población cree que el sangrado durante el cepillado es normal y solo es compartido por algunos médicos y enfermeros.

En cuanto a la relación de la enfermedad periodontal con otras enfermedades sistémicas cabe resaltar que alrededor de un tercio de la población y la mitad de los sanitarios respondieron afirmativamente. La relación periodontitis-diabetes fue reconocida por el 76% de médicos y 66% de enfermeros mientras que la relación periodontitis-enfermedad cardiovascular fue correctamente contestada por el 52% de los médicos y el 65% de los enfermeros.

Finalmente, en el tercer y último estudio transversal se analizó la asociación del conocimiento de la enfermedad periodontal y la asistencia habitual a clínicas dentales (al menos una vez por año). Un total de 3553 aceptaron la invitación y contestaron a las preguntas. La frecuencia de visitas al dentista disminuía con la edad y incrementaba con la familiaridad con el término periodontitis. Las mujeres predominan en el uso habitual, y estos son generalmente más jóvenes, con niveles educativos más altos y la probabilidad de padecer periodontitis es estadísticamente inferior que los que no acuden regularmente al dentista.

**Conclusiones**

- El numero de investigaciones acerca del conocimiento de la enfermedad periodontal es escaso y restringido a áreas geográficas con un nivel de desarrollo humano elevado. Esos estudios identifican lagunas en el conocimiento, siendo las más relevantes el bajo nivel de alerta, desconocimiento de la etiología y de la relación de la periodontitis con enfermedades sistémicas.
- Los considerados “muy conscientes acerca de la enfermedad periodontal” y por lo tanto un nivel más alto de conocimiento estaban entre los 40-60 años, llevan adecuados habitos de higiene oral y niveles educativos más elevados pero demuestran un conocimiento insuficiente de la etiología, signos y síntomas, riesgos asociados o factores de riesgo de la enfermedad periodontal.
- Hay un bajo nivel de conocimiento entre la población general y los principales referentes en salud, como son los médicos y enfermeros, desvelando alarmantes necesidades de intervención educativa para favorecer un diagnóstico y tratamiento temprano de la enfermedad periodontal.
- El uso habitual de los servicios dentales se relaciona con el conocimiento de la periodontitis. Las intervenciones especificas con el objetivo de educar a la gente en el problema periodontal durante la visita rutinaria al dentista pueden tener efectos positivos en el conocimiento de la enfermedad periodontal.

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# 1. INTRODUCTION

Periodontal diseases (PDD) can be broadly defined as biofilm-initiated inflammatory conditions, affecting the tooth supporting apparatus including a mild, reversible form (gingivitis), and frank periodontitis. Whereas gingivitis is considered an inflammatory condition, basically involving soft tissues of the gums, periodontitis irreversibly involves the surrounding bone support (The American Academy of Periodontology, 2001).

Periodontal disease is the 6th most common disease worldwide, with a prevalence of 11.2% and around 743 million people affected. The global burden of periodontal disease increased by 57.3% from 1990 to 2010 (Jin et al. 2011; Murray et al. 2012 Marcenes et al. 2013; Kassebaum et al. 2014).

The economic cost of periodontal disease in terms of loss of productivity has been estimated to be 54 billion USD/year while its financial impact accounts for 442 billion USD, including both direct and indirect costs (Listl, Galloway, Mossey & Marcenes, 2015). The overall prevalence increases with age and its incidence exponentially rises by the age of 30s, even in well-maintained populations (Heitz-Mayfield et al. 2003).

PDD have different patterns of progression. In the absence of oral hygiene and access to periodontal treatment, the burden of the disease will increase greately, with about 80% of the population reaching moderated stages of the disease, including a yearly attachment loss of 0.1 mm and a tooth mortality of 3 to 4 teeth at the forties (Löe, Ånerud, Boysen & Morrison, 1986). The remaining 20% will experience a rapid progression to advanced forms at earlier ages (Van der Velden et al. 2006).

As mentioned before, periodontal disease is an infection of bacterial origin with complex relationships between microorganisms. These microorganisms colonize mucosal and dental surfaces in the

mouth to form three-dimensional, structurally organized multispecies communities that are termed biofilms. They are firmly attached to the tooth surface, and they are not randomly distributed but spatially and functionally organized. There is a growing process common to all biofilms that starts with the formation of a conditioning film, mainly biologically active proteins (phosphoproteins and glycoproteins). Then, there is a reversible adhesion between oral cells and the conditioning film constituting a more permanent attachment involving interaction between specific molecules of the microbial cell surface with complementary receptors present in this conditioning film. Coadhesion is the process by which secondary colonizers attach to receptors on already attached bacteria. Finally, there is a maturation process with multiplication of periodontal pathogens leading to an increase in biomass and synthesis of exopolymers to form the biofilm matrix.

Basically, both the supragingival and subgingival microbiota have the same architecture but there are differences in the quantity of potential periodontal pathogens: while supragingival microbiota has an aerobic Gram + pattern, the subgingival species are composed in several layers with a more anaerobic pattern: the basal layer is composed by rod-shaped bacteria (Actynomices spp.), above which there is an intermediate layer composed by Fusobacterium nucleatum, an important bridging bacteria between early and late colonizers. The top layer consists of putative periodontal pathogens such as P. gingivalis, Porphyromonas endodontalis, and P. Intermedia.

In periodontal health there is a symbiosis between bacteria growing inside of the biofilms and the host immune response. Periodontitis develops when there is a dysbiosis in susceptible individuals, which leads to a connective tissue damage and alveolar bone loss (Meyle & Chapple, 2015; Sanz, 2017).

In advanced stages of periodontitis, once periodontal attachment has been destroyed by the infection, the disease can be difficult to manage because of the advanced signs and symptoms that further impact on quality of life: deep periodontal pockets, tooth mobility, pathologic tooth migration and ultimately tooth loss with masticatory disfunction (Tonetti, Jepsen, Jin & Otomo-Corgel, 2017). However,

earlier stages are often symptomless, and a significant number of affected patients do not seek professional dental care. Occasional gingival bleeding may be the only symptom noticed by patients until advanced stages of the disease are reached, when irreversibly mobile teeth occurs (Jin et al. 2011).

There is considerable evidence about the effects of periodontitis going beyond the oral cavity by an haematogenous dissemination of bacteria and their waste products originated in the biofilms and inflammatory mediators produced by the inflamed periodontium. (Loos, 2005; Kinane, Riggio, Walker, MacKenzie & Shearer, 2005; Forner et al. 2006). Through these mechanisms, periodontitis interacts with various systemic disorders, notably diabetes, and others such as atherosclerosis, obesity, and psychosocial stress. Diabetes has the strongest evidence in its relationship with periodontitis; type II diabetes demonstrated a dose-response relationship between severity of periodontitis and plasma levels of tumor necrosis factor alpha (TNF-a) (Engebretson et al. 2007) a cytokine that promotes insulin resistance (Gupta, Ten & Anhalt, 2005). Further support on the effect of periodontitis on diabetic state comes from the response to periodontal treatment in these patients, which results in a reduction of systemic inflammation (D'Aiuto et al. 2004; D'Aiuto et al. 2006; Paraskevas, Huizinga & Loos, 2008).

The incidence of oral diseases in general, and periodontal disease in particular, is higher in pregnant women, with gingivitis and periodontitis being the most common. Furthermore, there are some adverse outcomes associated to periodontitis during pregnancy such as preterm low birth weight and preeclampsia (McGregor, French, Lawellin & Todd, 1988).

The evidence for the role of genetics in periodontal disease merged from familial aggregation studies (Saxén, 1980; Van der Velden, Abbas & Van Steenbergen, 1989). Inheritance measures the proportion of phenotypic variation attributed to genetic factors. In this sense, genetically identically monozigotic twins demonstrated a two-fold increased risk of having early-onset periodontitis than dizigotic twins (Michalowickz et al. 2000). It is important to highlight that this study showed no evidence of inheritance for gingivitis and attributed

this disease phenotype to environmental factors such as oral hygiene habits and smoking.

Periodontitis is a chronic, non-communicable disease that shares risk factors with other inflammatory diseases such as diabetes, heart disease and chronic respiratory disease. Increased inflammatory markers in the bloodstream are associated with greater susceptibility for periodontal diseases and a worse response of the immune system against bacterial infection. Tobacco smoking, obesity, and poor nutrition have all been associated with greater risk of periodontitis (Chapple et al. 2017). Thus, longer life expectancy is related to a greater prevalence of periodontitis because most of the risk factors are acquired.

Periodontal diagnosis must include an overall assessment of the risk factors such as various systemic diseases that may interact with the disease or its treatment. An accurate periodontal diagnosis consists on a full mouth comprehensive evaluation: periodontal probing of the teeth at six surfaces per teeth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual) and periapical X-rays, followed by an appropriate treatment and secondary prevention.

Once a periodontitis case is diagnosed, it may be useful to stage the extent and severity and the presence of masticatory disfunctions of the individual based on the current measurable extent of destroyed tissue attributable to periodontitis, and assess the overall complexity, which are specific factors determining the difficulties in the management and control of the disease (Tonetti et al. 2017).

Professional dental cleaning and oral hygiene instructions can be enough for the management of gingivitis but, if not treated, it can further progress to periodontitis (Lang, Schätzle & Löe, 2009; Sälzer, Slot, Van der Weijden & Dörfer, 2015). This treatment initially consists on a non-surgical therapy: scaling and root planning, antiseptic and/or antibiotic prescription, but in some cases further surgical therapy may be required (Tomasi, Leyland & Wennström, 2007; Aljateeli et al. 2014). Long-term studies reported that after a complete periodontal therapy the rate of tooth loss dropped to 0.1/tooth/year, which is compatible with the preservation of the dentition for a lifetime (Matuliene et al. 2010; Chambrone,

Chambrone, Lima & Chambrone, 2010; Trombelli, Franceschetti & Farina, 2015). However, poor oral hygiene and non-compliance with periodontal therapy go along with progression of periodontitis and tooth loss (Hirschfeld & Wasserman, 1978; McFall, 1982; König, Plagmann, Rühling & Kocher, 2002).

Dental care is important for prevention of early signs of inflammation and progression of the disease. Periodontitis can be prevented through effective management of gingivitis and promotion of a healthy lifestyle (Chapple et al. 2015; Jepsen et al. 2017).

A pre-condition for treating any disease is the patient seeking consultation about signs or symptoms recognized as abnormal. Self-awareness of those signs and symptoms takes time and depends on the person´s background and health-related knowledge (Noonan, 2014). In the specific case of PDD, occasional gingival bleeding is often the only symptom noticed by patients until the advanced stages of the disease, when mobile teeth and periodontal abscesses frequently occur (Jin et al. 2011).

Late presentation is an important issue in PDD as advanced disease requires more complex treatments and is associated with a worse prognosis (Salvi et al. 2014; Graetz et al. 2015). Early diagnosis of PDD is the most effective way to reduce tooth loss avoiding masticatory disfunction, along with cost reductions. However, poor PDD awareness and their consequences have been reported as the most important factor for treatment failure on a community basis (Jin et al. 2011). This lack of awareness implies a delay in the diagnosis, and this is because early signs and symptoms are quite common among adult populations and those are painless (Dye, 2012). Various interventions have been undertaken to increase public periodontal awareness (Martensson, Söderfeldt, Halling & Renvert, 2004; Gholami, Pakdaman & Montazeri 2017) with positive results that could not be maintained over time (Gholami et al. 2017).

Positive attitudes towards oral health practices seem to be influenced by previous periodontal disease knowledge. Thus, it can be considered a pre-condition in order to take any additional approaches to improve oral health behaviour (Deinzer, Micheelis, Granrath & Hoffmann, 2009). Low periodontal knowledge may have a direct

influence in oral hygiene practices together with the existent belief that tooth loss is an unavoidable and direct consequence of ageing (Lin, Wong, Wang & Lo, 2001). Such attitudes and cultural beliefs can be detrimental to oral and periodontal health (Hosadurga, Boloor & Kashyap, 2015).

The KAP (knowledge-attitudes-practices) education model assumes the only obstacle for making positive health choices is ignorance. Therefore, information alone can induce changes in behaviour. Unfortunately, knowledge is a necessary but not sufficient condition for behaviour changing, tough this model is still useful. PDD knowledge can be grouped in 9 determinants that may modulate self-perceived periodontal health. (1) awareness of periodontal disease, a necessary precondition for a patient seeking specialist consultation, (2) knowledge about bacterial etiology, (3) risk factors, (4) signs and symptoms, (5) prevention of the disease, (6) systemic conditions associated to periodontal disease, (7) related risks (8) treatment and (9) attitudes towards the disease. In this sense, the retrieval of information about potential gaps of knowledge in all of these topics would facilitate specific, community-based interventions.

Once patients are aware that there is a problem with their gingivae, they would be expected to see their dentist. However, primary healthcare clinics seem to be the first place patients visit for consultation, as many patients with oral health concerns usually ask their physician rather than their dentist (Ahluwalia, Crossman & Smith 2016). In fact, 84.48% of the Spanish population had visited a physician, and just 40.5 % had visited a dentist in the same period (National Institute of Statistics, 2018). Some investigations have reported a lack of knowledge of primary care physicians about oral disorders (Mouradian et al. 2003; Rabiei, Mohebbi, Patja & Virtanen, 2012), and this may affect periodontal disease diagnosis. The role of primary care physicians and nurses in preserving their patients' oral health is particularly relevant as the Fédération Dentaire Internationale's (FDI) new definition of oral health promotes incorporation of it into the mainstream of health to ensure optimal oral and general health (World Dental Federation, 2017).

On the other hand, dental clinics seem to be the best place to undertake periodontal health education. Much of the burden of patient education lies with the dental hygienist, because of their positive influence on patient´s knowledge, motivation and attitudes to oral care (Ultembroek, Schaub, Tromp, & Kant, 1989), and also because dentists find important barriers for educating their patients such as lack of time, patient compliance or remuneration. Actually, hygienists find themselves highly skilled and knowledgeable about patient education, although it is not always implemented to those high standards, frequently lacking adequate assessment of patients' educational needs and showing poor patient empowerment (Rantanen et al. 2010). Unfortunately, no information on the performance of Galician dental clinics in periodontal health education could be retrieved.

Taking into account the existing literature, lack of knowledge about PDD could be a global phenomenon that may well affect our community to some degree. This phenomenon implies the already described undesirable consequences for the general population, which could be magnified if their natural formal referents in healthcare (physicians or nurses) are not proficient enough in periodontal health topics and dental clinics provide insufficient or inadequate periodontal health education.

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# 2. OBJECTIVES

- To identify the most relevant gaps of knowledge about PDD among the general public and to disclose whether they are culturally consistent.

- To assess the level of periodontal awareness among laypersons in Galicia and to disclose whether very periodontally aware people have higher level of knowledge.

- To assess periodontal knowledge among Galician primary healthcare physicians and nurses.

- To explore dental clinics´ performance on periodontal education in Galicia by comparing periodontal health knowledge among regular and inconsistent dental attenders.

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# 3. METHODOLOGY

## 3.1 Systematic Review

This review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) (Annex 1) guidelines and was registered in the International Prospective Register of Systematic Reviews (PROSPERO) - number CRD42015015883 –. (Annex 2.)

Papers were included if reporting on cross-sectional, community-based, quantitative studies on adult individuals (or ≥6% minors), providing original data about knowledge on PDD, and were written in English, German, French, Italian, Portuguese or Spanish languages. Publications on risk groups or reporting either on convenience samples or on population subgroups where a given level of health literacy could be presumed were excluded. This includes studies on patients with medical conditions, as most require regular contact with a healthcare provider: these individuals may/should have received oral health counseling to increase their level of knowledge.

The EMBASE, PubMed and SciELO databases were used for identifying relevant papers published from 1998 to 2014, together with a handsearch at the Galician network of university libraries. The search strategy was "periodontitis OR periodontal disease" and "knowledge OR awareness" as keywords and freetext and was undertaken in November 2014.

Two reviewers (PD-I and PV-C) independently searched the databases and reviewed both titles and abstracts. The results were discussed and merged into a single list including potentially eligible articles and those whose abstract provided unclear information. These publications were retrieved for full-text assessment and individually evaluated by both reviewers. Differences concerning eligibility were solved by consensus: when it was not attained, a third reviewer (JS-R) was called. The quality assessment was performed according to the criteria by Bennet et al. (2011), using 38 specifically designed items.

Each item was verified, and its presence recorded as “yes”, absence as “no”, and partially/unclearly present as “not clear”. Articles scoring >50% of “yes” items were allocated a low risk for bias, whereas those scoring >50% of “no” were classified “high risk for bias”. Any other circumstance was categorized as moderate risk.

Data extraction was independently undertaken by three reviewers (PD-I, AEG, PV- C) using a purpose-made form.

PDD were defined as “any inflammatory alteration of the gum (periodontium) in a dentate subject” in order to identify as many reports as possible. Gap of knowledge was defined as “the absence of answer, incorrect answer, or erroneous identification or definition given by 33% or more of the sample investigated in each study”. Awareness was defined as the act of "taking account" of a state of affairs (National Center for Biotechnology Information, 2015).

The primary outcome of this study (PDD knowledge) was the percentage of right answers to each question/item in relation to wrong/don't answer/don't know responses for each question and study. A secondary outcome (dimensions of periodontal knowledge) was defined as the combined percentages of incorrect responses for each item related to the following dimensions: awareness, etiology, associated risks, signs and symptoms, risk factors,
treatment, general knowledge, prevention, and attitudes.

The prevalence of gaps of knowledge in each dimension was presented as a percentage of questions where a deficit was identified related to the total number of questions made to investigate a given dimension in all the reports included in this review.

In order to determine the relative importance (RI) of the gaps in each dimension, a mathematical formula was developed using the number of papers investigating each dimension -research priority-, their methodological quality (Q) –headings: “methods”, “sample selection”, and “research tool” in table 2-, the depth in which each dimension is explored -number of questions made-, and the percentage of gaps of knowledge identified. (G):

$$RI_d = \sum Q_n * G_n$$

This approach permits weighting the importance of each dimension in the whole periodontal knowledge (the more relevant, the more reports would have investigated it), the quality of each individual investigation, and the importance of the gaps of knowledge in each dimension in each study.

## 3.2 Cross-sectional studies

### 3.2.1 Sociodemographic framework

After disclosing the most relevant gaps in the literature by means of the systematic review, we undertook three different cross-sectional studies in order to assess the consistency of our findings among the Galician general population and to evaluate the performance of their immediate health counselors (physicians, nurses, and dentists). These studies shared the same instrument but included minor variations in methods and samples studied.

The protocol of the investigations was approved by the Santiago-Lugo Committee for Ethics in Research (number 2014/600), (Annex 5) and complied with the Spanish regulations and the Helsinki Declaration on ethical principles for medical research involving human subjects (World Medical Association, 2013). The results obtained from this research protocol are reported following the STROBE guidelines (Strengthening The Reporting of Observational studies in Epidemiology) (Vandenbroucke et al. 2014) (Annex 3).

The fiedlwork was carried out in Galicia (North-Western Spain), an autonomous region with 2,708,339 inhabitants unevenly distributed in 29,574.4 $km^2$, whose gross domestic product per capita is 21,358 € and their life expectancy at birth of 82,78 years, reported by Instituto Galego de Estadística (IGE, 2018). The last study, about regular use of dental services and its relation to periodontal knowledge was done in the city of Ourense (North- west Spain), with an income per capita of 21,155 € and 105,893 inhabitants (IGE, 2018) who are served by 80 physicians and 85 nurses working at the primary care level (IGE, 2018) through a free, universal, national healthcare system.

Data from general population were obtained from 1 March 2015 to 30 June 2016 in the four Galician provinces (A Coruña, Lugo,

Ourense and Pontevedra), and data from healthcare workers were collected from October 1, 2016 to December 30, 2016. Only people over 18 entered the study. Exclusion criteria were being mentally handicapped and poor command of any of the official languages of the community (Galician or Spanish).

### 3.2.2 Instrument development

The studies were designed using an anonymous questionnaire applied in the community to randomly selected laypersons. This instrument included a set of 24 items: three questions about socio-demographic information (age, gender and education level), two questions about awareness (periodontitis/pyorrhoea), two about periodontal status (gum bleeding and tooth mobility), two about habits and routines and 15 about periodontal knowledge (Annex 4).

The most relevant items about periodontal disease were retrieved from those investigations entered in the systematic review (Varela-Centelles et al. 2016). This draft was assessed by a panel of experts who reviewed the contents in terms of relevance, clarity, simplicity, and need for each item. The resulting instrument was piloted in a group of five healthcare workers and its items corrected, reformulated, or deleted accordingly. The final version of the tool was piloted both in a group of 10 undergraduate dental students and in a group of 97 participants in leisure-time activities at a community center (mostly > 65 years).

Potential participants were approached with the words*, "Good morning/afternoon I am student from Santiago´s University, Medical and Dental School. I am conducting a very short survey about oral diseases, it only takes a couple of minutes, and the answers are anonymous so nobody will know your identity".* Twelve interviewers were involved in the study, four of them were dental students in their final year, whereas the remaining were postgraduate students. Participants were asked to enumerate the oral disorders/diseases they had heard of, and the first four registered in the questionnaire. When periodontitis/periodontal disease/pyorrhea was one of the answers, the participant was considered "very aware". If periodontitis was not mentioned, the interviewer would specifically ask whether the

participants had ever heard about periodontitis or pyorrhea. In case the participant would not recognize the specific pathology, an explanation of the disease was given: *"It is defined as an inflammation of the gums and supporting tissues of the teeth which leads to the destruction of the periodontal ligament and surrounding bone that normally hold the teeth*", and entered into the database as "not aware", finishing the questionnaire and gratefulling for the participation. "Aware" people was the other group of participants, who recognized the given term (periodontitis/ periodontal disease/pyorrhea).

### 3.2.3 Sample size calculation

Sample size was determined by considering an accessible population of 5% and an expected percentage of response of 28% (Rogers, Hunter & Lowe, 2011). The resulting sample size of 10,804 persons permitted a power of 0.8% for estimating the proportion of very periodontally aware people, presuming a value of 25%. A quota sampling method was used to achieve a reasonable balance by age, sex, and locality of the people in the four Galician provinces.

The second part of the study dealt with physicians and nurses comparing their answers with the general population in the city of Ourense. Sample size for the general population was determined by quota sampling considering an accessible population of 5% and an expected percentage of response of 28% (Rogers et al. 2011), resulting in a sample size of 1,034 individuals. This size permitted a power higher than 80% to detect 10% differences in the degree of periodontal knowledge. All primary care physicians and nurses working in the city were invited to enter the study.

### 3.2.4 Ethical considerations

The research protocol was approved by the Santiago-Lugo Committee on Research Ethics (#2014/600) (Annex 5). The investigation was undertaken in full accordance with the Declaration of Helsinki and the Spanish regulations. The results are presented according to the guidelines (Strengthening The Reporting of Observational studies in Epidemiology) (Vandenbroucke et al. 2014) (Annex 3).

### 3.2.5 Data collection and statistical analysis

Data were coded and entered into a database. Each questionnaire was identified by a single number, which permitted the assessment of the processes of data coding and mechanization in 40 randomly selected sets of data. Data were then transferred to a statistical package for analysis. For the sake of the analysis, missing data in knowledge-related items were considered as wrong answers. Descriptive analysis of categorical data displayed plain frequencies and percentages. Bivariate analysis was undertaken using the Chi square/Fisher's exact test with a chosen significance level of 5%.

A multinomial regression analysis was performed to identify the main sociodemographic features of the participants according to their awareness level. This approach permitted comparing more than two categories, taking one of them as a reference (very aware) and computing their ratios. The results are expressed in terms of odds ratio with their 95% confidence intervals. The level of significance chosen for all test was 5%.

The total number of correct answers were computed in three different areas: one question about aetiology (0-1 points), six questions about disorders related to periodontitis (0-6 points), another six about risk factors (0-6 points), and the total sum of them (0-13 points). The median of the distributions was chosen as a cut-off point to identify those participants with good (above the median) periodontal health knowledge. A logistic regression analysis was also undertaken to disclose hypothetical relationships between good periodontal knowledge and frequency of dental visits. ORs with their confidence intervals (CI) at 95% were calculated.

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# 4. RESULTS

## 4.1 Periodontitis awareness amongst general public: A critical systematic review to identify gaps of knowledge

The search strategy yielded 2,330 references. After removing duplicates, 1,567 single citations were identified and 310 of them were deemed relevant after assessing their titles. The abstracts of these papers were evaluated and 130 were discarded because they were not relevant for the aims of this investigation. Another 46 were excluded for studying risk groups, 81 used convenience samples, 19 included a significant number (≥6%) of non-adult participants, 7 papers were qualitative in nature, and 6 articles did not report on original data.

The full text of the remaining 21 papers was retrieved, and 6 additional reports were excluded for investigating convenience samples (Thomas, Bhat & Nair, 2005; Tascón et al. 2006; Demirer, Gursoy, Ozdemir, Erdemir & Uitto, 2012; Uysal, Akalin, Yamalik & Etikan.,2010; Macek et al. 2010; Richards, Filipponi & Roberts-Burt, 2014). Three papers were discarded for focusing on other aspects of Periodontology. An additional set of two reports was precluded for using non-original data (Schutzhold et al. 2014; Taylor & Borgnakke, 2007; Zhu, Petersen, Wang, Bian & Zhang, 2005). Another paper was rejected for language reasons (Li, Zhu, Zhang, Si & Liu, 2012), and a final group of three reports was excluded because they provided additional information about studies already published in another journal (Schwarz et al. 2001; Martensson, Soderfeldt, Andersson, Halling & Renvert, 2006; Gholami, Pakdaman, Jafari & Virtanen, 2014a). Therefore, 6 papers were finally selected for this systematic review (Croxson, 1993; Lin et al. 2001; Martensson et al. 2004; Airila-Mansson, Söder, Jin, Söder, & Klinge, 2004; Deinzer et al. 2009; Gholami et al. 2014b) (figure 1).

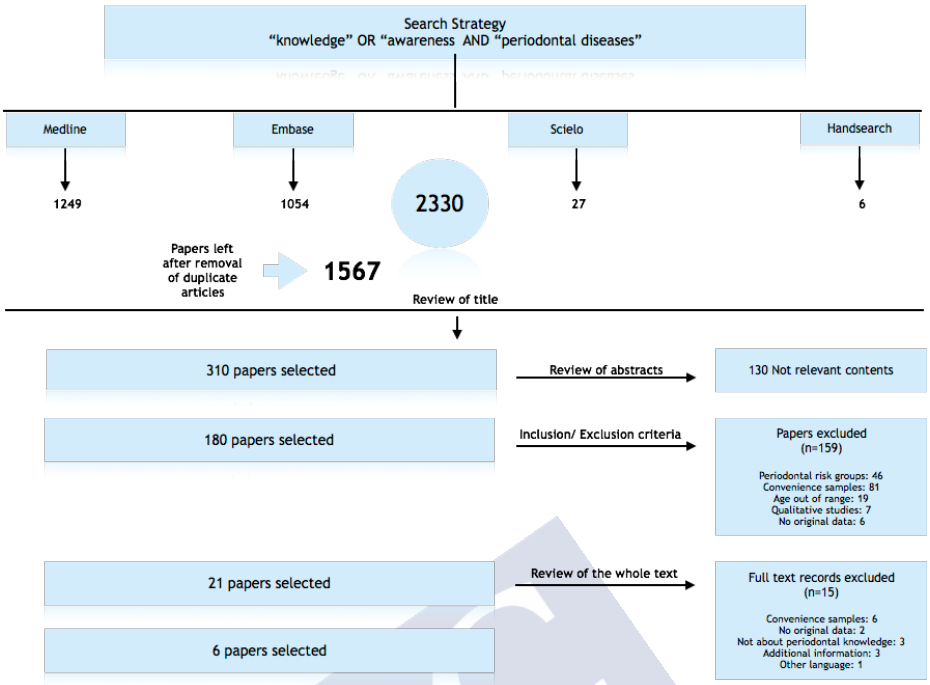


**Figure 1. Flowchart of the study**

Despite the information obtained from papers in systematic reviews is often limited by the methodological flaws of the original investigations, no reports were excluded for quality reasons.

A total of 7,945 individuals participated in the selected studies. Sample sizes ranged from 500 individuals to 3,088 interviewees, and included persons from three continents: Europe, Asia, and Oceania (table 1).

**Table 1. Summary of the papers considered for review.**

| Study | Sampling | Intervention | Objectives | Outcome | Relevant outcome | Risk of bias |
|---|---|---|---|---|---|---|
| Croxson, 1998. New Zealand | Random. 500 people throughout New Zealand | Telephone survey | To investigate changes in awareness and knowledge in New Zealand's population [implicit] | People are aware of the cause of periodontal disease, are less aware of disease in their own mouth as indicated by bleeding of gums, and do not seem concerned at such a problem when it does occur. | Lack of awareness and lack of concern. Confusion about relationship between aetiology and issues of care | High |
| Lin et al, 2001. China | Combination of multi-stage stratified sampling and quota sampling. 3,088 adults (35-44 and 65-74) in Southern China | Face-to-face interview | To describe the oral health knowledge, attitudes and practices or the urban and rural adults in the area, and the influence of various demographic and socio-economic factors | Adults have poor oral health knowledge but positive attitudes toward oral health. Some demographic and socio-economic factors were found to influence subjects' oral health knowledge, attitudes and practices. | Low dental knowledge. Lack of knowledge on periodontal diseases aetiology and prevention. | Low |
| Airila-Mansson et al. 2004. Sweden | Random sampling from a registry of inhabitants. 1676 adults (31-40) in the Stockholm region. | Self-applied questionnaire | To clarify the association between self-reporting of periodontal disease and outcome in a clinical examination and determine whether any difference is present in awareness of periodontal status between smokers and non-smokers. | Subjects who reported having periodontal disease, especially those also reporting having movable teeth, were confirmed to have the disease. Smokers were more aware of their periodontal status than non-smokers. | Most subjects think they have periodontal disease because of bleeding gums. One of the most common reasons explaining periodontits was "hereditary periodontitis". | Low |
| Martensson et al, 2004. Sweden | Random sampling from a national population register. 900 persons (50-75) | Mailed questionnaire | To investigate if a mass media campaign regarding periodontal disease could increase the knowledge in the general population of diagnoses, symptoms and treatment options of periodontal disease. | The campaign probably was successful from public health knowledge standpoint. | Insufficient knowledge about periodontal diseases signs and symptoms, and treatments | Low |
| Deinzer et al. 2009. Germany | Multistratified sample with area sampling (1st step), random digit dialling (2nd) step, and stochastic selection of the interviewee. 1001 people >14 | Telephone survey | To assess periodontitis-related knowledge and its relation to oral health behaviour on a community level and to identify target groups and major topics for health education interventions | Health education on periodontal diseases must be improved on a community level, although schoolchildren, older citizens and the less educated are the groups most in need. Interventions should focus on preventive measures. | Knowledge deficits about: definition of periodontitis, risks associated with it, periodontal risk factors, and preventive measures | Low |
| Gholami et al, 2014b. Iran | Stratified, multistage, random-area sampling. 791 adults (18-50) in Tehran. | Face-to-face interview | To assess knowledge of and attitudes towards periodontal health among adults in Tehran | Poor periodontal knowledge and a generally positive attitude towards and great appreciation of periodontal health. | Poor knowledge about aetiology and signs & symptoms of periodontal diseases. Low awareness. Good knowledge about oral hygiene. Positive attitude. | Low |

Most reports showed an adequate quality and a low risk of bias, whereas only one was found to be at high risk (Croxson, 1993) (table 2).

**Table 2. Quality assessment of the articles considered**

| Background | Croxson 1998 | Airila-Mansson 2004 | Deinzer 2009 | Gholami 2014b | Mårtensson 2004 | Lin 2001 |
|---|---|---|---|---|---|---|
| Justification of research method | Y | Y | N | N | N | N |
| Background literature review | Y | Y | NC | NC | NC | Y |
| Explicit research question | N | N | Y | N | Y | N |
| Clear study objectives | N | Y | Y | Y | Y | Y |
| Methods | | | | | | |
| Description of methods used for data analysis | N | Y | Y | Y | Y | Y |
| Method of questionnaire administration | Y | NC | Y | Y | Y | Y |
| Location of data collection | Y | Y | Y | Y | Y | Y |
| Dates of data collection | Y | Y | N | Y | Y | Y |
| Number and types of contact | N | Y | Y | Y | Y | Y |
| Methods sufficiently described for replication | N | NC | NC | Y | NC | Y |
| Evidence of reliability | N | N | Y | Y | N | NC |
| Evidence of validity | N | Y | Y | Y | N | NC |
| Methods for verifying data entry | N | N | N | N | N | Y |
| Use of codebook | N | N | N | N | Y | N |
| Sample selection | | | | | | |
| Sample size calculation | N | N | NC | Y | N | N |
| Representativeness | NC | Y | Y | Y | NC | NC |
| Method of sample selection | NC | NC | Y | Y | NC | Y |
| Description of population and sample frame | N | Y | Y | N | N | Y |
| Research tool | | | | | | |
| Description of the research tool | N | NC | Y | Y | Y | Y |
| Description-development of research tool | N | N | Y | Y | N | N |
| Instrument pretesting | NC | N | Y | Y | N | Y |
| Instrument reliability and validity | N | N | Y | Y | N | N |
| Scoring methods | N | N | Y | Y | N | Y |
| Results | | | | | | |
| Results of research presented | Y | NC | Y | Y | Y | Y |
| Result address objectives | NC | Y | Y | Y | Y | Y |
| Clear description- result based on part sample | Y | Y | Y | Y | N | Y |
| Generalisability | NC | NC | Y | Y | NC | NC |
| Response rates | | | | | | |
| Response rates stated | N | Y | Y | Y | Y | N |
| How response rate was calculated | N | NC | NC | NC | N | N |
| Discussion of nonresponse bias | N | N | Y | N | Y | N |
| All respondents accounted for | NC | NC | N | Y | Y | Y |
| Interpretation and discussion | | | | | | |
| Interpret and discuss findings | Y | Y | Y | Y | Y | Y |
| Conclusions and recommendations | NC | Y | Y | Y | Y | Y |
| Limitations | N | N | N | Y | Y | N |
| Ethic and disclosure | | | | | | |
| Consent | N | NC | N | Y | NC | NC |
| Sponsorship | N | N | Y | Y | N | Y |
| Research ethic approval | N | N | N | Y | N | N |
| Evidence of ethical treatment of human subjects | N | NC | NC | Y | Y | N |

**Y:** yes; **N:** no; **NC:** not clear

Raw data from each study were used to identify gaps of knowledge about a question, and these questions were grouped into 9 "dimensions" of periodontal knowledge. The grouping process and the results obtained are depicted in table 3a & 3b in order to preserve the richness of the original data and to clarify the procedure. Unfortunately, one paper shows information about certain variables grouped under a common heading and it was impossible to calculate raw data (Airila-Mansson et al. 2004).

**Table 3a. Gaps of knowledge identified in the literature**

| Paper | Dimension | Item | | Gap of knowledge |
|---|---|---|---|---|
| Croxson, 1998 | Aetiology | What causes gum disease? | | Yes |
| New Zealand | Awareness | If your gums bleed, does this worry you? | | Yes |
| 500 respondents: adults | Attitudes | If your gums bleed, what do you do about it? | | Yes |
| Lin et al, 2001 | Aetiology | Perceived cause of gum disease | | Yes |
| China | Prevention | Perceived preventive methods for gum disease | | Yes |
| 3,088 respondents in two groups: | | Regular visits to the dentists prevent dental problems | | No |
| 35 to 44 and 65 to 74 years old | Attitudes | Just like birth, aging and death, loss of teeth is a natural process | | Yes |
| | | State of teeth is decided at birth and is not related to self-care | | Yes |
| | | Poor teeth are detrimental to one's appearance | | No |
| | | State of my teeth is of great importance to me | | No |
| | | Keeping natural teeth is not important | | No |
| | | Dental problems can affect the body as a whole | | No |
| | | False teeth will be less of a bother tan natural teeth | | No |
| Airila-Mansson et al, 2004 | General aspects | Do you think you have periodontal disease (PD)? | | No |
| Sweden | Signs and symptoms | Why do you think you have PD?: Bleeding gums | | Grouped data |
| 1,655 respondents: 31 to 40 y.o. | | Why do you think you have PD?: Mobile teeth | | Grouped data |
| | Aetiology | Why do you think you have PD?: hereditary periodontitis | | Grouped data |
| Martensson et al, 2004 | Signs and symptoms | Do you know which of the following troubles and symptoms that may indicate that you suffer from caries or periodontitis? | Bleeding gums | No |
| Sweden | | | Mobile teeth | No |
| 559 respondents: 50 to 75 y. o. | | | Increased space between the teeth | No |
| | Treatment | Do you know which of the following types of treatments and examinations that are intended for caries and periodontitis? | Scaling | No |
| | | | Gingival surgery | No |
| | | | Pocket probing | Yes |
| | | | X-ray examination | Yes |
| | Prevention | Careful dental higiene | | No |
| | | Cleaning between the teeth | | No |

**Table 3b. Gaps of knowledge identified in the literatur**

| Paper | Dimension | Item | | Gap of knowledge |
|---|---|---|---|---|
| Deinzer et al, 2009 Germany 1,001 respondents: 14 to 89 years old | Aetiology | Periodontal disease is caused by dental plaque | | No |
| | Awareness | In early stages one recognizes periodontitis by frequent tooth aches | | Yes |
| | General aspects | What is periodontitis? | | Yes |
| | | What is periodontitis? Five alternative answers | | Yes |
| | | The most frequent oral disease in adults is caries | | Yes |
| | | A periodontitis often remains unrecognized for years | | No |
| | | Not just older persons are susceptible to periodontitis | | No |
| | | Untreated periodontitis will ultimately cause tooth loss | | No |
| | Related risks | People suffering from periodontitis do have an increased risk for other disorders: do you know any of these disorders? | | Yes |
| | | Please assess whether patients with peridontitis have an increased risk for these diseases. 12 alternatives | Myocardial infarction | Yes |
| | | | Tooth loss | No |
| | | | Persistent damage of the alveolar bone | No |
| | | | Diabetes | Yes |
| | | | Preterm birth | Yes |
| | Risk factors | Do you know any risk factors for periodontal disease? | | Yes |
| | | Please assess which of the following factors are risk factors for periodontitis | Gingivitis | No |
| | | | Dental calculus | No |
| | | | Plaque bacteria | No |
| | | | Nicotine consumption | Yes |
| | | | Stress | Yes |
| | | | Diabetes | Yes |
| | Prevention | If one manages to sustain very good oral hygiene he or she will not suffer from periodontitis | | No |
| | | One cannot avoid emergence of dental calculus | | Yes |
| | | To really get the teeth clean by daily brushing above all one has to brush them firmly | | No |
| | | The fewest patients manage to sustain optimal oral hygiene without the help of their dentist | | No |
| | | To avoid periodontitis, it is of particular importance to brush the chewing surfaces | | Yes |
| | | Industry provides several devices for oral hygiene. Which of them are absolutely necessary to maintain good oral health? | Tooth brush | No |
| | | | Toothpaste | Yes |
| | | | Interdental hygiene | No |
| Gholami et al, 2014 Iran 791 respondents: 18 to 50 years old | General aspects | What is dental plaque? | | No |
| | Awareness | Bleeding gums during brushing is normal | | Yes |
| | | In spite of any preventive care in relation to gum disease, I worry about getting the disease | | Yes |
| | Aetiology | What causes gum disease? | | Yes |
| | Signs and symptoms | How would you describe healthy gums? | | Yes |
| | | Which one is an early sign of gum disease? | | Yes |
| | | Which one is the outcome of progressed gum disease? | | Yes |
| | Related risks | Which of the following systemic diseases affects progression of gum disease? | | Yes |
| | Risk factors | Avoiding smoking prevents gum disease | | No |
| | Prevention | Mostly gum disease is preventable | | No |
| | | Twice a day tooth brushing together with flossing is efficient in preventing gum disease | | No |
| | | Regular dental visits can prevent gum disease | | No |
| | | If I haven't eaten food, tooth brushing is not necessary | | Yes |
| | | I believe that only in situations with pain or problems must I visit a dentist | | Yes |
| | | In my opinion, scaling is harmful for gum health | | No |
| | | Brushing with salt prevents gum disease | | Yes |
| | Attitudes | Undesirable gum status will affect people's work and their social relations | | No |
| | | Oral and dental diseases are less important than other diseases | | No |
| | | I don't like my teeth to appear longer than normal because of gum diseases | | Yes |

When all dimensions were considered, a higher percentage of knowledge deficits was identified in "periodontal awareness" (80%), followed by "PDD aetiology" (75%). Less frequent gaps were disclosed in issues related to attitudes towards the disease (36.36%) and prevention (36,84%) (table 4).

**Table 4. Summary of the distribution of the gaps of knowledge identified in this critical systematic review**

| | Papers studying each dimension | Depth of the study (number of | Gaps of knowledge n (%) |
|---|---|---|---|
| Awareness | 3 | 5 | 4 (80%) |
| Etiology | 5 | 5* | 3 (75%) |
| Related risks | 2 | 7 | 5 (71.43%) |
| Signs & Symptoms | 3 | 8** | 3 (50%) |
| Risk factors | 2 | 8 | 4 (50%) |
| Treatment | 1 | 4 | 2 (50%) |
| General aspects | 3 | 8 | 3 (37,5%) |
| Prevention | 4 | 19 | 7 (36,84%) |
| Attitudes | 3 | 11 | 4 (36,36%) |

* One question was excluded because of absence of raw data; ** Two questions were excluded because of absence of raw data

The methodological quality of the selected papers (presence of the items under the headings "methods", "sample selection", and "research tool" detailed in table 2) was expressed as a percentage divided by ten, and showed a wide variation among studies, ranging from 1.58 to 8.42. Martensson et al. (2004) and Airila-Mansson et al. (2004). scored both 3.68; and Lin et al. (2001). and Deinzer et al. (2009) reached 6.32 and 7.37 respectively.

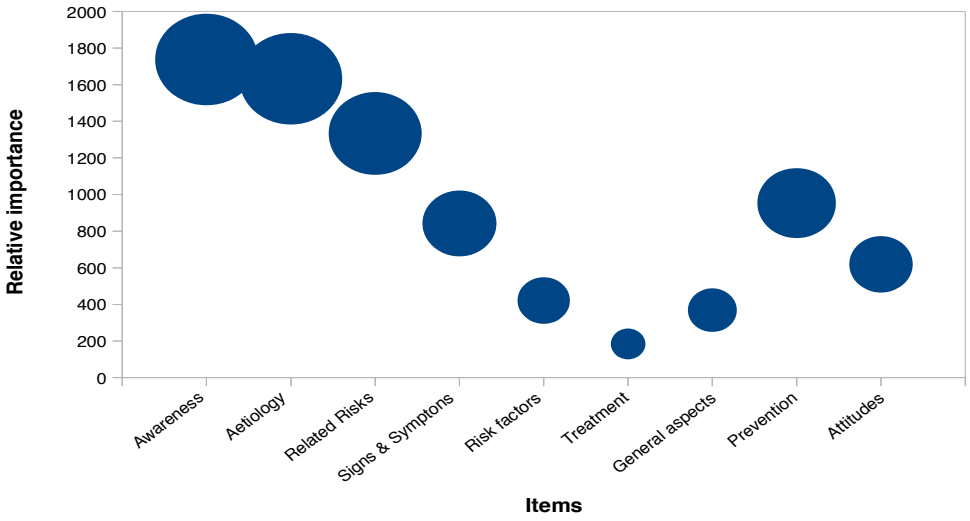


**Figure 2. Relative importance of gaps of knowledge**

The application of the formula for relative importance of the lack of knowledge in each dimension highlighted the need for educational interventions about disease awareness and etiology, and also revealed a weak knowledge about the relationship between PDD and systemic disorders (fig. 2). The size of each point in the figure is related to the relative importance of each dimension in the deficit in periodontal knowledge considered as a whole.

**4.2 Periodontal awareness and what it actually means: A cross-sectional study**

A total of 8,206 subjects were invited to enter the study, and 3,553 of them accepted the invitation (43.3%).

All completed questionnaires were useful for the aims of the investigation.

The main socio-demographic features of the sample are summarized in table 5. Most participants were classified as "periodontally aware" (1,517; 42.7%), and only 19.4% (n=689) could be included in the "very aware" group according to the criteria set for the study. More than one third of the interviewees had not heard about periodontitis/pyorrhoea and were categorised as "not aware" (1,347; 37.9%). The "very aware" group included a higher percentage of women (373; 54.1%). Periodontal awareness seemed to increase with age and diminished among people elder than 64. The very aware group included a higher proportion of university graduates (table 5).

**Table 5. Main features of the sample studied and distribution of the awareness level.**

| Variable | Total (n=3553) | Not aware (n= 1347) | Aware (n= 1517) | Very aware (n= 689) | p-value |
|---|---|---|---|---|---|
| Gender | | | | | <0.001 |
| Male | 1744 (49.1) | 756 (56.1) | 671 (44.2) | 316 (45.9) | |
| Female | 1809 (50.9) | 591 (43.9) | 856 (55.8) | 373 (54.1) | |
| Age group | | | | | <0.001 |
| 18-34 | 1062 (29.9) | 526 (39.0) | 379 (25.0) | 157 (22.8) | |
| 35-44 | 695 (19.6) | 214 (15.8) | 326 (21.4) | 155 (22.5) | |
| 45-64 | 1007 (28.3) | 264 (19.6) | 485 (31.9) | 258 (37.3) | |
| >64 | 789 (22.2) | 343 (25.6) | 327 (21.5) | 119 (17.3) | |
| Educational achievements | | | | | <0.001 |
| Compulsory education | 1054 (32.6) | 442 (42.5) | 468 (31.0) | 144 (20.9) | |
| High School | 988 (30.6) | 402 (38.7) | 426 (28.2) | 160 (23.2) | |
| Vocational training | 441 (13.6) | 81 (7.8) | 244 (16.1) | 116 (16.9) | |
| University degree | 750 (23.2) | 112 (11.0) | 371 (24.7) | 267 (39.0) | |

n (%); p-value obtained from Chi Square test.

Our results permitted the identification of gaps of periodontal knowledge among the very aware group of laypersons in all aspects explored except for "prevention" and "treatment" (table 6a, table 6b).

**Table 6a. Gaps of periodontal knowledge among very aware laypersons (n=689)**

| Dimension | Item | N (%) | *Gap |
|---|---|---|---|
| Aetiology | Acknowledge bacterial aetiology | 116 (16.8) | Yes |
| Risk factors | Age | 411 (61.5) | Yes |
| | Diabetes | 369 (55.4) | Yes |
| | Genetics | 499 (74.7) | No |
| | Hygiene | 649 (97.1) | No |
| | Tobacco | 629 (94.1) | No |
| | Bacteria | 641 (95.9) | No |
| Signs & symptoms | Able to mention 2 symptoms of periodontitis/pyorrhoea | 323 (46.8) | Yes |
| | Gums should not bleed at gentle toothbrushing | 452 (67.6) | No |

*Gap was defined as the absence of answer, incorrect answer, or erroneous identification given by at least 33% of the sample.

The presence of gaps of knowledge about aetiology, in the recognition of signs or symptoms, or about the relationship of periodontitis with other disorders were particularly interesting and showed that even this population subgroup was susceptible to a potential delay in diagnosis of periodontitis, which may be aggravated by the reported lack of adequate oral self-care routines and dental check-ups.

Age, higher education, and adequate oral self-care practices were related to periodontal awareness. In fact, periodontally aware people were likely to be in their late forties-early sixties, follow sound oral

care routines, and hold a professional or university degree. Gender or tobacco habit did not seem to have a clear part in this issue.

**Table 6b. Gaps of periodontal knowledge among very aware laypersons (n=689)**

| Dimension | Item | N (%) | *Gap |
|---|---|---|---|
| Related risks | Periodontitis can be related to other disorders | 396 (59.3) | Yes |
| | Periodontitis can be linked to cardiovascular disorders | 281 (42.0) | Yes |
| | Periodontitis can be related to diabetes | 295 (44.1) | Yes |
| | Periodontitis can be related to adverse pregnancy outcomes | 104 (15.6) | Yes |
| | Periodontitis can be linked to jawbone damage | 563 (84.2) | No |
| | Periodontitis can be linked to tooth loss | 642 (96.1) | No |
| Prevention | Periodontitis can be prevented | 582 (87.3) | No |
| | You cannot avoid calculus formation in the mouth | 519 (77.7) | No |
| | Scaling damages teeth | 523 (78.2) | No |
| Treatment | Periodontitis can be treated | 605 (90.9) | No |
| Attitudes | Report good routine of oral self-care practices | 117 (16.9) | Yes |
| | Regular dental check-ups (on a yearly basis) | 425 (61.7) | Yes |

*Gap was defined as the absence of answer, incorrect answer, or erroneous identification given by at least 33% of the sample.

Our results showed periodontal awareness consistently increased with educational achievements: any additional degree beyond compulsory education halved the chances for being in the "not aware" group. Besides, each step in the educational ladder increased the probabilities for being in the very aware group by about 20% (figure 3).

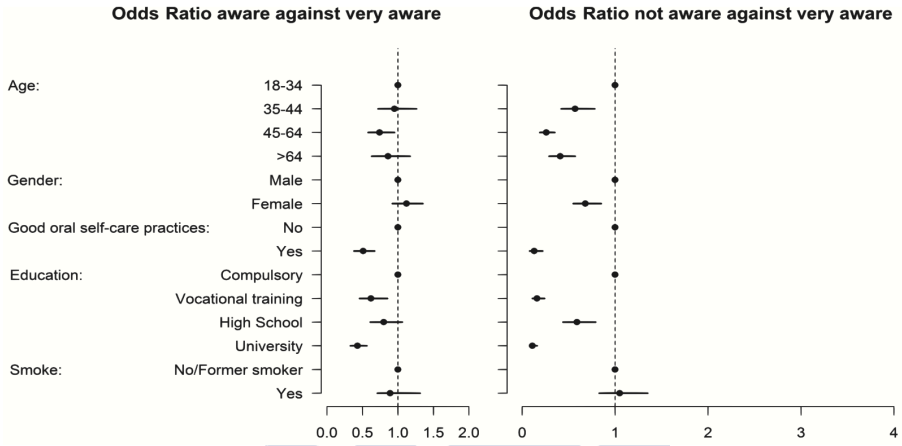


**Figure 3. Graphic representation of OR for the "aware" and "not aware" groups (Reference: "very aware" group)**

In an attempt to disclose whether the reported periodontal knowledge was conditioned by actually experiencing the disease, a new variable was constructed using two specific questions in the instrument: "Do your gums bleed?" and "Do you have any mobile tooth?". Those interviewees answering "yes" to both questions were considered to have high chances of experiencing periodontitis. Only 38 subjects (8.2%) in the very aware group met these criteria. These individuals resulted to be elder ($p=0.034$), with lower educational achievements ($p<0.001$), and with a history of tobacco habit ($p=0.038$) more frequent than their counterparts in the very aware group. In terms of knowledge, very aware periodontitis-affected participants

linked less frequently (23.6%) periodontitis with cardiovascular diseases than their fellow members with healthy periodontium (42.9%; p=0.042). The same phenomenon occurred regarding jawbone affectation (71% vs. 85.1%; p=0.044). Concerning signs and symptoms, periodontally-affected very aware people were not so good both at recognising the abnormality of gum bleeding with gentle toothbrushing when compared to other members of the very aware subgroup of participants (36.8% vs. 70%; p<0.001), and at acknowledging that periodontitis can be treated (92.2% vs. 73%; p<0.001). Periodontitis-affected people in the very aware group also thought more frequently that periodontitis cannot be prevented when compared to very aware persons who did not report gingival bleeding and tooth mobility (65.8% vs 90%; p<0.001). No significant differences could be identified in terms of annual dental check-ups between both groups (63% vs. 63.1%; p=0.991).

### 4.3 Primary care physicians and nurses: Targets for basic periodontal education

A total of 2,375 people were invited to enter the study (2,210 members of the public, 80 physicians, and 85 nurses). The percentage of responses was 60% for the general population (n=1,326), 83.75% for physicians (n=67), and 80% (n=68) for nurses. No person was excluded from the study. The main reason argued by those declining entering the study was lack of time. All questionnaires were fully completed and were included in the study. The results are summarized in tables 7a & 7b.

Most participants (54.39%; n=799) were males in the age group 45-64 (36.83%; n=541). All nurses and physicians were familiar with periodontitis whereas less than half of the general population group had ever heard of periodontitis either by its technical or common names (table 7a).

**Table 7a. Summary of the main results of the study. (PDD: periodontal diseases; p-values obtained by Chi square test)**

| Variables | | Lay population n (%) | Physicians n (%) | Nurses n (%) | p-value |
|---|---|---|---|---|---|
| Age group | 18-34 | 314 (2.34) | 2 (2.98) | 7 (10.29) | <0.001 |
| | 35-44 | 252 (19) | 7 (10.45) | 8 (11.76) | |
| | 45-64 | 430 (32.43) | 58 (86.57) | 53 (77.94) | |
| | >64 | 330 (24.89) | 0 (0) | 0 (0) | |
| Gender | Male | 766 (57.77) | 25 (37.31) | 8 (11.76) | <0.001 |
| | Female | 560 (42.23) | 42 (62.68) | 68 (88.24) | |
| Level of education | University | 120 (9.8) | 67 (100) | 68 (100) | <0.001 |
| | High School | 502 (41.3) | 0 (0) | 0 (0) | |
| | Compulsory | 596 (48.9) | 0 (0) | 0 (0) | |
| Ever heard of periodontitis | Yes | 624 (47.1) | 67 (100) | 66 (97) | <0.001 |
| Aetiology of periodontitis | Genetics | 51 (8.1) | 1 (1.4) | 2 (3) | 0.051 |
| | Age | 26 (4.1) | 0 (0) | 0 (0) | 0.068 |
| | Alcohol | 8 (1.2) | 0 (0) | 0 (0) | 1 |
| | Tobacco | 64 (10.2) | 0 (0) | 0 (0) | <0.001 |
| | Bacteria | 25 (4) | 23 (34.3) | 11 (16.6) | <0.001 |
| | Poor hygiene | 457 (73.2) | 57 (85) | 56 (84.8) | 0.017 |

n= number of people; %= percentage of people in each group; p-value (<0,001 statistically significant)

When questioned about the causes of periodontal diseases, only 4% in the general population group mentioned bacteria. This view was shared by one-third of physicians and about two in ten nurses. When questioned about risk factors, most participants included bacteria in their answers and around two-thirds of healthcare workers and three quarters of laypersons recognize a part for inheritance in periodontal diseases (table 7b).

**Table 7b. Summary of the main results of the study. (PDD: periodontal diseases; p-values obtained by Chi square test) ---------**

| Variables | | Lay population n (%) | Physicians n (%) | Nurses n (%) | p-value |
|---|---|---|---|---|---|
| Periodontal risk factors | Genetics | 460 (76.9) | 42 (62.6) | 44 (66.6) | 0.012 |
| | Age | 423 (70.7) | 55 (82.1) | 49 (74.2) | 0.023 |
| | Tobacco | 527 (88.1) | 67 (100) | 65 (98.4) | <0.001 |
| | Bacteria | 495 (82.7) | 67 (100) | 66 (100) | <0.001 |
| | Poor hygiene | 592 (98.9) | 67 (100) | 66 (100) | 1 |
| | Diabetes | 397 (66.5) | 55 (82.1) | 52 (78.7) | 0.005 |
| PDDs signs & symptoms | Don't know | 154 (24.6) | 0 (0) | 3 (4.5) | <0.001 |
| | Red gums | 90 (14.4) | 11 (16.4) | 14 (21.2) | 0.293 |
| | Bleeding gums | 139 (22.2) | 34 (50.7) | 33 (50) | <0.001 |
| | Tooth mobility | 218 (34.9) | 5 (7.4) | 4 (6) | <0.001 |
| | Gum recession | 73 (116) | 18 (26.8) | 17 (25.7) | <0.001 |
| | Tooth loss | 85 (13.6) | 1 (1.4) | 3 (4.5) | <0.001 |
| | Food impaction | 2 (0.3) | 0 (0) | 0 (0) | 1 |
| | Tooth sensitivity | 48 (7.7) | 5 (7.4) | 1 (1.3) | 0.168 |
| PDDs can not be prevented | Agree | 47 (7.8) | 1 (1.4) | 2 (3) | 0.065 |
| You can't avoid calculus formation | Agree | 251 (41.9) | 2 (2.9) | 3 (4.5) | <0.001 |
| There is no treatment for PDDs | Agree | 90 (15) | 0 (0) | 0 (0) | 0.001 |
| Some gum bleeding is normal when brushing teeth | Agree | 265 (44.3) | 6 (8.9) | 10 (15.1) | <0.001 |
| Scaling damages teeth | Agree | 114 (19) | 0 (0) | 2 (3) | <0.001 |
| PDDs linked to other health problems | Agree | 221 (37) | 35 (53) | 31 (47) | 0.082 |
| PDDs linked to tooth loss | Agree | 540 (90.3) | 66 (98.5) | 66 (100) | 0.002 |
| PDDs linked to jawbone damage | Agree | 409 (68.4) | 66 (98.5) | 66 (100) | <0.001 |
| PDDs linked to heart infarction | Agree | 155 (25.9) | 35 (52.2) | 43 (65.1) | <0.001 |
| PDDs linked to diabetes | Agree | 332 (55.5) | 51 (76.1) | 44 (66.6) | 0.001 |
| PDDs linked to pre-term birth | Agree | 151 (25.2) | 21 (31.3) | 21 (31.8) | 0.310 |

n= number of people; %= percentage of people in each group; p-value (<0,001 statistically significant)

Regarding early symptoms of periodontal disorders, very few participants recognized gingival redness as a sign of periodontal problems. Gingival bleeding was mentioned by about half of primary care workers and by less than one quarter of the laypersons in the study. Conversely, tooth mobility is understood as a symptom of periodontal disease by one-third of the population and very few healthcare professionals. Laypersons also acknowledge better results regarding tooth loss as a consequence of periodontitis (table 7b).

Another interesting finding is that 44.3% of the population think gingival bleeding when brushing is normal, and this opinion is shared by some physicians and nurses. In fact, 45.1% in the public group, 28.4% of physicians, and 28.8% of nurses acknowledge gingival bleeding when tooth brushing ($p=0.009$).

When asked about a hypothetical relationship between periodontal diseases and other health conditions, one-third of laypersons answered affirmatively, together with about half of healthcare workers. The relationship between diabetes and periodontitis is better known by the sample, although statistically significant differences remain between groups. The link with cardiovascular disorders was recognized to a lesser extent by the sample, with the group of nurses scoring higher percentages of correct answers (almost two-thirds). The question about the relationship between periodontitis and pregnancy outcomes scored the lowest percentages of correct answers in this group of items. These results are shown in more detail in table 7b.

When the analysis was restricted to the highest educated members of the public in our sample, the percentage of those familiar with periodontitis reached 56.4%. In this group, 11.1% acknowledged the bacterial aetiology of periodontitis. This proportion is significantly lower than that recorded for healthcare professionals ($p=0.002$). This difference in favour of physicians and nurses can also be seen when dealing with risk factors (table 8) with the exception of the role of the individual's genetic background where lay persons identified more frequently the right answer.

**Table 8. Risk factors for periodontal diseases.**

| Item | University Graduates (n =120) | Physicians (n= 67) | p-value* | Nurses (n= 68) | p-value** |
|---|---|---|---|---|---|
| Genetics | 75 (85.2) | 42 (62.6) | **0.002** | 44 (66.6) | **0.011** |
| Hygiene | 87 (98.9) | 67 (100) | 1.000 | 66 (100) | **1.000** |
| Tobacco | 79 (89.8) | 67 (100) | **0.005** | 65 (98.4) | **0.044** |
| Age | 64 (72.7) | 55 (82.1) | 0.185 | 49 (74.2) | 0.856 |
| Bacteria | 82 (93.2) | 67 (100) | **0.037** | 66 (100) | **0.038** |
| Alcohol | 54 (77.1) | 55 (82.1) | | 52 (78.7) | 0.763 |

Values in absolute cases and percentages in brackets. p-value calculated using Fisher's exact test.
*p value resulting from comparing university graduates with physicians.
**p value resulting from comparing university graduates with nurses.

When questioned about a hypothetical relationship of PDDs with other health conditions, the sample was almost equally divided between those who find a relationship and those who do not, and no statistically significant differences were found among the three groups (p=0.956). Physicians and nurses recognize oral-related problems more accurately than their general population counterparts, as well as cardiovascular problems (table 9) but no differences were identified regarding diabetes and adverse pregnancy outcomes, as healthcare professionals answered in the same way as university graduates did.

**Table 9. Relationship of PDDs with other health conditions.**

| Health problem | University Graduates (n =120) | Physicians (n= 67) | p-value* | Nurses (n= 68) | p-value** |
|---|---|---|---|---|---|
| Tooth loss | 79 (89.8) | 66 (98.5) | **0.044** | 66 (100) | **0.011** |
| Damage to jaw bone | 74 (84.1) | 66 (98.5) | **0.002** | 65 (98.4) | **0.002** |
| Myocardial infarction | 31 (35.2) | 35 (52.2) | **0.049** | 43 (65.2) | **<0.001** |
| Diabetes | 58 (65.9) | 51 (76.1) | 0.214 | 44 (66.7) | **1.000** |
| Preterm birth | 25 (28.4) | 21 (31.3) | 0.725 | 21 (31.8) | 0.723 |

Values in absolute cases and percentages in brackets. p-value calculated using the Fisher's exact test.
*p value resulting from comparing university graduates with physicians.
**p value resulting from comparing university graduates with nurses.

An interesting finding is that related to the identification of PDDs (table 10): holding a healthcare degree does not seem to warrant a better knowledge of early (red and bleeding gums) and advanced (tooth mobility and tooth loss) symptoms and signs of periodontal diseases. In fact, laypersons seem to recognize tooth mobility and tooth loss as symptoms of PDDs more frequently than do physicians and nurses.

Despite these findings, only 8.9% of physicians and 15.1% of nurses find normal some degree of gum bleeding when brushing their teeth, compared to 27.1% of other university graduates (p=0.018).

**Table 10. Signs and symptoms of PDDs**

| Sign/symptom | University Graduates (n =120) | Physicians (n= 67) | p-value* | Nurses (n= 68) | p-value** |
|---|---|---|---|---|---|
| Not answer/don't know | 12 (13.3) | 0 (0) | **0.001** | 3 (4.5) | 0.098 |
| Reddish gums | 20 (22.2) | 11 (16.4) | 0.421 | 14 (21.2) | 1.000 |
| Gum bleeding | 44 (48.9) | 34 (50.7) | 0.872 | 33 (50.0) | 1.000 |
| Tooth mobility | 31 (34.4) | 5 (7.4) | **<0.001** | 4 (6.1) | **<0.001** |
| Gum recession | 11 (12.2) | 18 (26.8) | **0.023** | 17 (25.7) | 0.063 |
| Tooth loss | 27 (30.0) | 1 (1.5) | **<0.001** | 3 (4.5) | **<0.001** |
| Tooth sensitivity | 11 (12.2) | 5 (7.5) | 0.428 | 1 (1.5) | **0.014** |

Values in absolute cases and percentages in brackets. p-value calculated using the Fisher's exact test.
*p value resulting from comparing university graduates with physicians.
**p value resulting from comparing university graduates with nurses.

**4.4 Regular dental attendance and periodontal health knowledge. A cross-sectional survey.**

A total of 8,206 individuals were invited to enter the study, and 3,553 accepted the invitation (response rate: 43.3%). All questionnaires were included in the analysis.

The first question in the survey was whether the participant had heard about periodontitis/pyorrhoea (yes: 62.1%; n=2,206; no: 37.9%; n=1,347). Volunteers were classified by the frequency of their dental visits as "regular users" (at least once a year) (59.3%; n=1,945) or "inconsistent users" (any other response) (40.7%; n=1,339). The frequency of regular dental visits diminished with age and increased both with periodontal disease familiarity and academic achievements (table 11). Females predominate among regular dental attenders (65%; $p<0.001$); regular users of dental services are also significantly younger, higher educated, and less likely to be experiencing periodontitis than their counterparts occasionally visiting their dentist (table 11).

More than one third (37.9%; n=1,347) of the participants had never heard of periodontitis, and many (54.4%; n=589) fit within the regular dental attenders' group.

Those familiar with the disease were questioned about different aspects of periodontal health and about their preventive attitudes. In this subset of patients, regular users accounted for 61.5% of the sample (n=1,356). When asked about the aetiology of periodontitis, few participants (12.4%; n=272) answered correctly (bacteria), but significant differences could be observed between regular (15.4%; n=210) and inconsistent (7.3%; n=62) users of dental services ($p<0.001$). Regular dental attenders recognised health problems related to periodontitis better than the group of inconsistent users (table 12). When asked to mention at least two symptoms of periodontitis, regular attenders also performed better than their counterparts (42.4% vs 31.4%; $p<0.001$). The same occurred when asked whether they find normal to experience some bleeding when toothbrushing (31.6% vs 44.7%; $p<0.001$).

**Table 11. Mean features of the whole sample by frequency of dental visits.**

| Variable | n | Regular users (1945) | Inconsistent users (1339) | p-value |
|---|---|---|---|---|
| Gender | | | | <0.001 |
| Male | 1605 (48.9) | 854 (53.2) | 751 (46.8) | |
| Female | 1678 (51.1) | 1091 (65.0) | 587 (35.0) | |
| Age | | | | <0.001 |
| 18-34 | 943 (28.7) | 658 (69.7) | 285 (30.3) | |
| 35-44 | 652 (19.9) | 412 (63.2) | 240 (36.8) | |
| 45-64 | 971 (29.5) | 555 (57.1) | 416 (42.9) | |
| >64 | 718 (21.9) | 320 (44.5) | 398 (55.4) | |
| Do your gums bleed? | | | | <0.001 |
| No | 2066 (62.9) | 1298 (62.8) | 768 (37.2) | |
| Does not know | 13 (0.4) | 3 (23.0) | 10 (77.0) | |
| No teeth | 25 (0.8) | 1 (4.0) | 24 (96.0) | |
| Yes | 1180 (35.9) | 643 (54.5) | 537 (45.5) | |
| Do you have any mobile tooth? | | | | <0.001 |
| No | 2724 (83.0) | 1698 (62.3) | 1026 (37.7) | |
| Does not know | 79 (2.4) | 15 (18.9) | 64 (81.1) | |
| No teeth | 70 (2.2) | 8 (11.4) | 62 (88.6) | |
| Yes | 407 (12.4) | 222 (54.5) | 185 (45.5) | |
| Heard of periodontitis | | | | <0.001 |
| No | 1081 (33) | 589 (54.4) | 492 (45.6) | |
| Yes | 2203 (67) | 1356 (61.5) | 847 (38.5) | |
| Smoker | | | | <0.001 |
| Former | 499 (16) | 249 (49.9) | 250 (50.1) | |
| No | 1923 (59) | 1236 (64.2) | 687 (35.8) | |
| Yes | 812 (25) | 438 (53.9) | 374 (46.1) | |
| Educational achievements | | | | <0.001 |
| Compulsory education | 1054 (33) | 488 (46.3) | 566 (53.7) | |
| High School | 987 (30) | 634 (64.2) | 353 (35.8) | |
| Vocational training | 441 (14) | 259 (58.7) | 182 (41.3) | |
| University degree | 749 (23) | 540 (72.1) | 209 (27.9) | |

Values in absolute cases and percentages in parentheses
p-value calculated using the Chi-square test.

Regarding periodontal risk factors (table 12), both oral hygiene and smoking were well recognised by the sample. Other factors were better recognised by the group of regular users. It is worth mentioning participants attribute bacteria a relevant role in periodontitis, but only as a risk factor, not as an aetiological agent.

When asked about preventive attitudes and beliefs, 90.8% (n=1,176) regular attenders said periodontitis can be prevented compared to 85.6% (n=658) of inconsistent users (p<0.001). These differences diminish when questioned about whether periodontitis can be treated (89.8% vs 85.9%; p=0.008). The same phenomenon occurred with the distribution of non-smoking volunteers in both groups (78.8% vs 72.9%; p=0.001).

Participants were also classified by their reported oral self-care routines in two groups: adequate routines (toothbrush and interdental cleaning at least once a day) and inadequate practices (any other response). Although the number of interviewees reporting adequate routines was low, regular attenders consistently reported better habits (14.6% vs 5.9%; p<0.001).

**Table 12. Risk factors and relationship with other health problems.**

| Topic | Total (2079) | Regular users (1302) | Inconsistent users (777) | p-value |
|---|---|---|---|---|
| **In your opinion, periodontitis is linked to:*** | | | | |
| More chances for another disease | 1102 (53) | 743 (57.1) | 359 (46.2) | <0.001 |
| Tooth loss | 1977 (95.1) | 1250 (96.0) | 727 (93.5) | 0.012 |
| Damage to jawbone | 1650 (79.4) | 1081 (83.0) | 569 (73.2) | <0.001 |
| Heart infarction | 716 (34.4) | 477 (36.6) | 239 (30.7) | 0.002 |
| Diabetes | 932 (44.8) | 625 (48.0) | 307 (39.5) | <0.001 |
| Adverse pregnancy outcomes | 376 (18.1) | 261 (20.1) | 115 (14.8) | <0.001 |
| **What increases the chances of experiencing PDs? *** | | | | |
| Genetics | 1493 (71.8) | 983 (75.5) | 510 (65.6) | <0.001 |
| Hygiene | 2045 (98.4) | 1286 (98.7) | 759 (97.6) | 0.068 |
| Smoking | 1929 (92.8) | 1219 (93.6) | 710 (91.3) | 0.154 |
| Age | 1344 (64.6) | 885 (67.9) | 459 (59.0) | <0.001 |
| Bacteria | 1689 (81.2) | 1230 (94.4) | 459 (89.1) | <0.001 |
| Diabetes | 1447 (69.6) | 764 (58.7) | 683 (49.2) | <0.001 |
| **Overall knowledge score:** | | | | |
| Disorders related to periodontitis** | | 3 (2 - 4) | 3 (2 - 4) | <0.001 |
| Risk factors** | | 5 (4 - 6) | 5 (4 - 6) | <0.001 |
| Total score** | | 9 (7 - 10) | 8 (6 - 9) | <0.001 |

*Values in absolute cases and percentages in parentheses. p-value calculated using the Chi-square test; **PDs**: periodontal diseases

**Values in medians and interquartile ranges. p-value calculated using the Mann-Whitney's U test.

Regular dental attenders also elicited better periodontal knowledge than their inconsistent counterparts (table 12). Logistic regression analysis (figure 4) showed the chances for having an above-median periodontal health knowledge are almost equally influenced by higher education (OR 1.64; 95%CI: 1.30-2.06) and regular use of dental services (OR 1.67; 95%CI: 1.40-2.00), and negatively conditioned by age (>64: OR 0.68; 95%CI: 0.51-0.90).

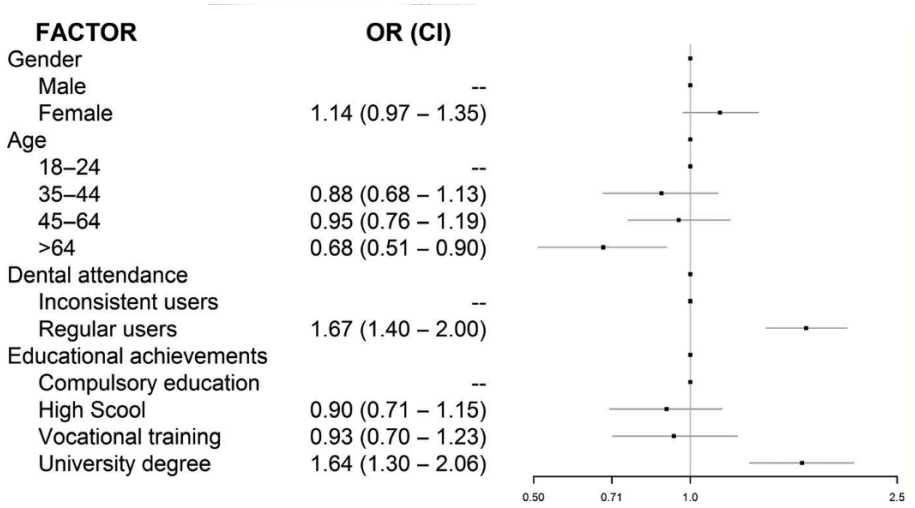


**Figure 4. Logistic regression analysis to disclose factors influencing periodontal knowled**

In an attempt to further disclose the part of educational achievements in periodontal health knowledge, the group of participants with compulsory education was explored in more detail (table 13), and inconsistent dental users showed significantly poorer results in all aspects but aetiology of periodontitis.

**Table 13. Distribution of periodontal knowledge among the "compulsory education" subgroup**

| Overall knowledge score | Regular users (302) | Inconsistent users (327) | p-value |
|---|---|---|---|
| Aetiology* | 22 (7.3) | 16 (5.1) | 0.247 |
| Disorders related to periodontitis** | 3.08 (1.6) | 2.74 (1.5) | 0.007 |
| Risk factors** | 4.88 (1.3) | 4.45 (1.4) | <0.001 |
| Total score** | 8.06 (2.5) | 7.26 (2.5) | <0.001 |

*Values in absolute cases and percentages in parentheses. p-value calculated using the Chi-square test.
**Values in means and standard deviations in parentheses. p-value calculated using the Student's t test.

As participants with higher chances of being experiencing periodontal problems could be more likely to require periodic dental care, volunteers reporting both bleeding gums and tooth mobility were identified. The distribution of these participants by their frequency of dental visits showed no significant differences (7.3% vs 7.7%; p=0.698). Not all regular dental attenders likely to be experiencing periodontitis were familiar with the disease (51.5%; n=73).

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# 5. DISCUSION

The diagnosis of a disease is the result of a chain of events where patients and clinicians interact conditioned by the signs and symptoms of the disorder and the health system (Sogaard, 1988; Holtzman, Atchison, Macek, & Markovic, 2017). Assuming that certain awareness and knowledge are required for an early diagnosis, assessing it at a community level seems to be a logical precondition for an educational intervention. Although this assessment has necessarily to be undertaken on a local basis, published reports point at a deficit of periodontal knowledge worldwide, which seems to be independent from the geographical area and type of population studied (Martensson et al. 2004; Gholami et al. 2014b). Despite knowledge is just a single aspect among a series of factors affecting health attitudes, it can be considered a pre-condition of additional measures to improve oral health-related conducts. (Deinzer et al. 2009).

The results obtained from our investigations have confirmed the initial hypothesis that there is a general problem in terms of awareness and knowledge about periodontal disease, which is a global phenomenon, even affecting countries and regions with a high human development index (Varela-Centelles et al. 2016). It has been suggested that the social determinants of health (i.e., educational background, economic status, living conditions lifestyles, and working environment) are largely responsible for oral health inequalities worldwide (Petersen & Ogawa, 2005; Petersen, Kandelman, Arpin, & Ogawa, 2010). Among the three most relevant oral diseases (caries, PDD and oral cancer), periodontal disease exhibits the strongest association with social, economic and behavioural risk variables (Hobdell et al. 2003), Therefore, interventions that modify socioeconomic environment and enhance control of risk factors are important strategies for promotion of oral health in the community.

Despite that no study included in the systematic review presented in this PhD dissertation assessed all aspects about periodontal knowledge, the employed methodology let to identify the level of awareness, aetiology and related risks as the most important deficits in knowledge among the population. These findings were also confirmed for the Galician population, even in the "very aware" subgroup of the population, with a higher level of education (Varela-Centelles et al, 2019).

There are two main actors in the diagnosis of the disease: the patient and the healthcare professional. The time elapsed until an adequate treatment is started traditionally depends on the patient readiness to seek advice and on the knowledge of the clinician. The patient should be able to distinguish normalcy from disease and the clinician should be able to recognize early signs and symptoms to adequately address patient´s needs. Unfortunately, our results have unveiled a worrying lack of knowledge about aetiology and signs and symptoms of both primary care physicians and nurses. Chronic periodontal disease is also very common among the adult population frequently visiting their physician for systemic conditions. If the medical practitioner is unable to recognise early signs and symptoms of periodontal disease in a patient, this person would rarely be sent to an oral healthcare professional (Mouradian et al. 2003; Rabiei et al. 2012).

The third mainstay that modulate an early diagnosis, the Health System, represents a very relevant factor in Galicia due to the reduced number of dental practitioners working in the national health service and the limited periodontal treatments offered on a free, universal basis (preventive actions for children and pregnant women) (https://www.sergas.es/Asistencia-sanitaria/Documents/892/guiatecnica_saudebucodental.pdf).), which means that the burden of treatment of oral pathologies lies on the private sector.

In this way, our research has demonstrated a positive effect of regular dental attendance in terms of periodontal knowledge. A recent systematic review found that educational interventions in health services offer significant improvements in periodontal outcomes,

concluding that educational interventions undertaken by health professionals in the context of their practice have the potential to promote oral health in the population (Menegaz, Silva & Cascaes, 2018).

Psychological interventions have become a matter of interest because of their reported positive effects (Kakudate, Morita, Sugai & Kawanami, 2009), although the certainty of evidence in support of these approaches is low and therefore, they not should yet be routinely provided in dental care (Werner et al. 2016). The "Motivational Interview" is one of these promising psychological interventions with usually good acceptance by patients, although aspects such as the best number of sessions and their length, together with the level of training required to use it effectively and the optimal timing and targets have not been sufficiently investigated (Randall, 2018). Another issue with oral health promotion are the methods of evaluation, which are reported to be poor and in need of further development (Watt, Fuller, Harnett, Treasure & Stillman-Lowe, 2001), with the lowest performing measures in the categories of healthy lifestyle and health literacy (Watt et al, 2006). In this sense, our indirect approach to the issue of periodontal health promotion in dental clinics may offer an approximation to the problem and a starting point for further research and interventions on this topic.

The results of our research show a worrying lack of knowledge and awareness of PDD, that tough common to other developed countries, is aggravated due to important gaps of knowledge amongst the professionals in our health system (Primary care physicians and nurses). All these factors combined describe a problematic situation in the normal diagnosis pathway for such a high prevalent disease (PDD).

### 5.1 Limitations

There are some limitations that must be mentioned. In general, our investigations dealt with attitudes towards oral health problems. It is just about what people would do or even they report to do, but the actual behaviour cannot be objectively known. To be aware about

something does not necessarily imply a correct behaviour (i.e warnings on tobacco packets to favour quitting smoking).

The definition of a gap in our investigations (33% or more of wrong/blank responses) was arbitrarily chosen. Probably, different results would be obtained with another definition, but this level of discrimination permits identifying areas where interventions at a community level would be clearly justified.

This research project was developed with cross-sectional studies, which is an instant picture of the actual situation, while knowledge and attitudes of a population are constantly changing and those are sensitive to sociocultural changes and mass media (TV, Internet), which nowadays are considered the main information channel (Cutili, 2010). However, different studies in Europe were developed with the same methodology disclosing similar results (Deinzer et al. 2009; Martensson et al. 2004).

Another potential weakness of our study is the limited number of subjects enrolled in the survey, far from the total sample initially calculated. Thus, the precision of the study was recalculated for the sample size finally obtained (3,553), considering it an infinite population. It resulted a probability for a precision error of 1.4% in the estimation of a proportion by an asymptotic 95% bilateral confidence interval, assuming an expected proportion of 28%. In any case, to date, this is the study with the largest sample and the first of its kind undertaken in Southern Europe.

A hypothetical limitation of our results could come from the side of the response rate. Although it may seem low, it is somehow similar to the ones obtained by other research groups using the same methodology (e.g.: Rogers et al. (UK 2011): 28%; Campbell et al, 30% (Australia 2009); Fan et al, 50% (Hong Kong 2016)), so we assume that our percentages seem to be quite satisfactory for our research approach.

A possible information bias (where the interviewer did not ensure all participants received the same information when questioned) was controlled by selecting motivated and knowledgeable interviewers. To prevent this bias, all interviewers participated on a workshop to discuss all aspects of the investigation, which included supervised

practice (Varela-Centelles et al. 2019). The questionnaire included indications for the interviewer to connect the different items in the instrument ensuring a homogeneous interview. Some items in the instrument were presented in negative form, whose correct response required the participant to disagree with the interviewer in order to control for the reported trend of interviewees to give ideal responses when asked direct questions (Lin et al. 2001).

There is also the possibility for a selection bias, as potential participants with poorer attitudes towards oral health may have refused to participate more frequently than those with positive ones. This phenomenon, if occurred, would only contribute to highlight the important deficit of periodontal knowledge disclosed by our results and reinforce the need for educational interventions on this topic.

Periodontitis was not accurately diagnosed in our sample because no periodontal checking was performed. It is an important limitation when talking about periodontal/non periodontal patients, but data available so far about self-reported periodontal conditions are inconsistent (Blicher, Joshipura & Eke, 2005; Ramos, Bastos & Peres, 2016). This inconsistence has been attributed to the threshold used to define periodontal disease in clinical examination (gold standard), the participant's age, the severity of the disease, the cross-cultural adaptation of the questionnaire items, and the access and use of dental services (Dietrich et al. 2005; Cyrino, Miranda, Pereira, Bastos & Costa 2011; Eke et al. 2013).

When choosing a proxi for advanced periodontitis, our group faced three main difficulties: i) to the best of our knowledge, there were no questionnaires validated in Galician or Spanish Spanish (Castilian) languages when the study was designed, ii) the number of items for reporting periodontitis had to be very limited in order to obtain the shortest possible questionnaire for our study, and iii) the items could not deal with "periodontitis/gingivitis/pyorrhoea" (we expected a high proportion of participants unaware of the disease) or with information from a dentist/hygienist (we also expected a high percentage of inconsistent attenders). Thus, questions such as "Have you ever been told you have gingival/gum problems/ gingivitis/ pocketing/ periodontitis?" which achieved high validity scores in

previous reports could not be used in our investigation. In this situation we selected two items: the first one, “Do your gums bleed?” has proved good validity (Ankkuriniemi & Ainamo, 1997; Buhlin, Gustafsson, Andersson, Håkansson & Klinge, 2002), does not seem to be affected by cross-cultural adaptation, and offers better concordance with clinical examination than other self-reported periodontal parameters (Blicher et al. 2005). The second item, - “Do you have any mobile tooth?”- can hardly be affected by cultural aspects, offers good validity (Glavind & Attström, 1979; Gilbert & Nuttall, 1999), is also easy for the patients to notice in themselves, and it is related to severe periodontal disease (Blicher et al. 2005).

Critics often question whether self-report is a valid measure at all in Periodontics. Self-report is considered a suitable measure in routine use for many different conditions and diseases (e.g.: hypercholesterolemia, self-reported blood pressure, etc). When checking validity scores for these parameters, bleeding gums and tooth mobility showed validation results similar to, or even better than, those given by other, more accepted, self-report measures outside of oral health (Bilcher et al. 2005).

There is also the issue of that there was no universally accepted threshold of periodontal disease, and comparisons with different thresholds of attachment loss, bone loss, or pocket depth will give different levels of validity, as well as the chosen cut-off point for accepting validity. These variations may contribute to explain the inconsistencies observed in the literature and hamper the use of self-reported periodontal data for diagnosis, but they are still a valuable tool for epidemiological studies of periodontal health (Buhlin et al. 2002) and for identifying individuals in need of oral healthcare services (Myers-Wright, Cheng, Tafreshi & Lamster, 2018).

Generalization of our results may be compromised as the study was performed in the capital cities of Galician provinces, but taking into account the size of the analysed sample, the power of the study, and the wide range of areas of data collection —gathering approximately 68,6% of the population (IGE, 2018) and 68,2% of dental clinics (Galician Health Service, 2017) in the region within a 40´travel from each city— make us think our results may offer a

dependable picture of the actual situation of periodontal health awareness. Representativity of the results is granted by the sampling method, where participants were randomly approached in different streets and commercial areas of the city (with different socioeconomic frameworks), at different hours and days, in a kind of pathfinder survey which was proposed by the World Health Organization (WHO, 2010); moreover, by using a quota sampling method to ensure a proportional representation of age strata, and the size of the sample studied.

### 5.2 Interpretation of the results

Our results show a disappointing picture of a community where, despite having a ratio of dentists per capita above the European average reported by the "Consejo general de colegios de Odontólogos y Estomatólogos de España" (CGCOE, 2016), more than one third of the participants had never heard about periodontitis/pyorrhoea, and just one in five interviewees could be considered to be very aware of the mere existence of periodontitis. Similar proportions have been reported in Colombia (Duque, Cuartas, Muñoz, Salazar & Sanchez, 2011) or Nigeria (Savage, 1994). No participant in a Germany-wide survey could give the correct definition of periodontitis and only 11% demonstrated passive knowledge of its definition (Deinzer et al. 2009). These findings support our results and indicate a considerable need for periodontal health awareness in the Galician community.

The second most relevant gap identified in the systematic review, the aetiology of PDD (Varela-Centelles et al, 2016) is particularly important, as correct information on this topic may modulate attitudes towards treatment and prevention. A great proportion (83,2%) of our "very aware" sample could not mention the bacterial origin of PDD, even though it was established by the middle of 20$^{th}$ century. Existing reports show a wide range of percentages of correct answers to aetiology-related items [e.g. Iran (13.8%) (Gholami et al. 2014b), Jordan (26.8%) (Taani, 2002) or Germany (77.8%) (Deinzer et al. 2009)]. In these studies, dental plaque is considered the right answer, but the concept laypersons have of dental plaque is not always accurate (Gholami et al. 2014b; Taani, 2002) and may not necessarily

include bacteria among its components—the idea behind de question, which is ensured in our study—.

This poor periodontal health knowledge about aetiology of PDD significantly influences daily oral hygiene practices and periodontal care provided by dentists and dental hygienists (Jin et al, 2011).

Evidence about the connection between periodontal disease and systemic diseases has been discussed for decades and it has increased in the last ten years (Jepsen et al. 2017). We found an important gap of knowledge about systemic disorders clearly associated to periodontitis. Although this is a common finding in the literature (Deinzer et al. 2009; Gholami et al. 2014b), the high percentage of people ignoring the relationship between diabetes and periodontitis (55.9%) in this subgroup of patients is particularly noteworthy, as periodontitis was defined "the sixth most common complication of diabetes" by the end of last century (Löe, 1993). Another interesting finding of our results is the very low percentage of people recognising the link between periodontitis and adverse pregnancy outcomes (15,6%). Available literature concludes that maternal periodontitis is significantly associated to preterm birth, low birth weight and preeclampsia (Ide & Papapanou, 2013). Efforts must be made in order to increase the knowledge about systemic diseases related to periodontitis, especially in those risk groups of the population.

In these circumstances, our results show a dependable first picture of the problem of periodontal awareness in Spain. Unawareness may be a reason for periodontal health inequalities (Jin et al. 2011), which can condition general health and quality of life (Petersen et al. 2010).

There is now sufficient evidence about the link of periodontal disease to systemic conditions and the number of modifiable risk factors that periodontitis has in common with certain non-communicable chronic diseases (Jürgensen, Petersen, P, Ogawa & Matsumoto, 2012). It is somehow disheartening that almost half of the physicians were not aware about the relationship of PDDs and cardiovascular pathologies, which is considered the most important cause of deaths in Spain (NIS, 2018). When asked about diabetes and adverse pregnancy outcomes, reported knowledge by primary care nurses or physicians did not differ from that of university graduates.

This is an important barrier to PDDs diagnosis, given both the reported burden of oral conditions represent on general medical practice (Cope, Wood, Francis & Chestnutt, 2015), and the fact that many patients would consult their physicians rather than their dentist (Ahluwalia et al, 2016; Lockhart, Mason, Konen, Kent & Gibson, 2000; Madrid, Bouferrache & Moller, 2006).

The regular use of dental services showed a positive effect in terms of periodontal knowledge and awareness. However, our results disclosed that around one third of regular users of dental services had never heard about periodontitis (Table 11). Health education during dental visits is usually limited by time and frequently addressed to a particular problem (Raidi, Thornley & Thornley, 2015).

Regression analysis permitted to identify the person with better periodontal knowledge: younger females holding a university degree and regularly attending their dentist. Those with higher education and lower age were above the median of knowledge, probably because new generations receive more health counselling and they use more regularly dental services.

### 5.3 Repercussion of the results in the clinic and health policy

The call for global action on the burden of periodontal diseases endorsed by the European Federation of Periodontology, together with other learned national societies of periodontology (Tonetti et al. 2017), highlights the need for enhancing public awareness of the early signs of the disease and improving patient and healthcare professionals information about periodontal treatment and the interdependence of periodontal health and systemic health. Our results suggest that an increase on awareness and periodontal health knowledge is related to a regular use of dental services. Patient education has been established itself as an important part of patient care (Horving et al, 2010) and patients expect clinicians both “to act as encouraging informers, explorers of everyday life and reflective partners” (Liira, 2011) and to engage in the development of oral health literacy in their communities (Hughes, Heo, & Levin, 2018).

In this sense, a perceived distance apparently hinders interprofessional collaboration between dentists and physicians

(Sippli, Rieger & Huettig, 2017). Medical and dental professionals should work together to raise public awareness and promote good oral health as part of the healthy lifestyles message (WHO, 2010; Ford et al. 2010). As a European directive establishes common requirements for basic medical and nursing training, this problem may well be found elsewhere in the European Union (European Union, Directive 2005/36/EC). Increasing awareness of common dental and periodontal pathologies among physicians and nurses would favour an early diagnosis. The size of the problem is obviously related to the prevalence of regular dental check-ups, as those areas whose population is more reluctant to visit the dentist regularly rely more on the physicians' periodontal knowledge.
Increasing public's periodontal information is intuitively positive and strengthening oral health education will lead to improved attendance at scheduled dental check-ups (Sato & Oda, 2011), which in turn, increases the chances for opportunistic education in dental offices.

Lack of knowledge may influence periodontal health inequalities (Jin et al. 2011), and PDD shares modifiable risk factors with a range of chronic systemic disorders (Jürgensen et al. 2012). This circumstance offers an opportunity for policy-makers and institutions to promote periodontal health knowledge among lay public, which may contribute to reduce the observed gap between regular and occasional dental attenders.

### 5.4 Future research

Future investigations should address educational interventions that must include general population and physicians and nurses, which are important figures in our Public Health System, to increase the level of awareness and the importance of an early diagnosis. Furthermore, those interventions must be monitored to see the medium and long-term effect on periodontal knowledge and attitudes towards PDD.

Continuation of this line of research beyond the limitations of our studies and to promote educational programmes in public dental clinics to increase people awareness of PDD would provide interesting benefits to the community

Oral health literacy, conceived as knowledge on the causes of oral diseases, ability to apply this understanding and to incorporate self-care behaviours, and also to navigate the healthcare system when needed, should be a research priority. Finally, an assessment of off-clinic periodontal counsellors together with the evaluation of periodontal information available through mass media or from online sources seems to be a logical step to increase periodontal awareness and early diagnosis of periodontal diseases.

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# 6. CONCLUSIONS

- The number of available community-based investigations on periodontal knowledge is scarce and restricted to areas with a very high level of human development. These studies identify gaps of knowledge in every geographical area, being the more relevant a low awareness, poor knowledge about the etiology of PDD and their relationship with systemic disorders.

-Very periodontally aware people were in their late 40–60 s, followed sound oral care routines and held a degree but elicited insufficient knowledge about aetiology, signs-symptoms, related risks or periodontal risk factors.

-There is a low degree of periodontal knowledge both amongst the public and their primary care physicians and nurses and unveil unreliable targets (primary healthcare workers) for educational interventions to improve early diagnosis and treatment of periodontal disorders.

-Reported regular dental attendance is related to periodontal health knowledge. Specific interventions for promoting tailored patient education on periodontal topics during routine dental visits may have a positive effect on laypersons' knowledge about periodontal health.

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# 8. ANNEXES

## Annex 1. PRISMA Statement

http://www.prisma-statement.org/documents/PRISMA%202009%20checklist.pdf

## PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | |

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | |
| **FUNDING** | | | |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | |

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

## Annex 2. PROSPERO registration

https://www.crd.york.ac.uk/PROSPERO/documents/Registering%20a%20review%20on%20PROSPERO.pdf

UNIVERSITY of York
Centre for Reviews and Dissemination

NHS
National Institute for
Health Research

PROSPERO International prospective register of systematic reviews

# A systematic review and metasummary of periodontal diseases awareness: knowledge about aetiology, prevention, and risk factors among the general public

*Pablo Varela-Centelles, Juan M. Seoane-Romero, Pedro Diz-Iglesias*

**Citation**
Pablo Varela-Centelles, Juan M. Seoane-Romero, Pedro Diz-Iglesias. A systematic review and metasummary of periodontal diseases awareness: knowledge about aetiology, prevention, and risk factors among the general public. PROSPERO 2015:CRD42015015883 Available from
http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42015015883

**Review question(s)**
What are the most relevant gaps of knowledge about periodontal diseases?

Are these gaps geographically consistent?

**Searches**
We will search the following electronic bibliographic databases: EMBASE, PubMed, and SciELO. The search strategy will include the terms periodontitis and knowledge or awareness, as keywords or free text. The searches will be limited to the last 16 years. Only papers in English, German, French, Italian, Portuguese, or Spanish will be considered.

Titles of the papers identified using the search strategy will be screened to detect studies that potentially meet the inclusion criteria outlined elsewhere. Abstracts of the selected set of papers will be reviewed and filtered according to the objectives of the study, and those articles hypothetically relevant will be retrieved for a full-text assessment. A second author will review these papers, and any disagreement between authors will be resolved through discussion with a third author until a consensus is reached.

**Types of study to be included**
Cross-sectional, community-based, quantitative studies.

**Condition or domain being studied**
Knowledge about periodontal diseases.

**Participants/ population**
Adults.

**Intervention(s), exposure(s)**
Periodontal diseases are defined as any inflammatory disorder of the periodontium (gums) in a dentate individual.

A gap of knowledge about an item is defined as an absence or incorrect identification or definition of that particular item by 33% or more of the sample studied.

**Comparator(s)/ control**
Differences between geographical areas will be investigated.

**Context**
Studies investigating knowledge and awareness about periodontal diseases among the general public will be considered.

Papers focusing on risk groups or reporting on convenience samples will be excluded, as well as research on

particular population subgroups where a given level of health literacy can be presumed.

**Outcome(s)**

**Primary outcomes**

Knowledge about particular aspects of periodontal diseases defined by the percentage of right answers vs the percentage of wrong and “blank/don’t know” responses (gaps of knowledge) for each item and study.

**Secondary outcomes**

Knowledge about aetiology, prevention, risk factors, and treatment of periodontal diseases, defined by pooled percentages of correct answers to the items related to each of the aforementioned headings.

**Data extraction, (selection and coding)**

A standardised, pre-piloted form covering the items suggested by Bennet et al (PLoS Med 2011; 8: e1001069) will be used for assessment of study quality and evidence synthesis. Extracted evidence will include: author, sampling, intervention, objectives, main outcomes of the paper, and outcomes relevant for the topic of this systematic review.

**Risk of bias (quality) assessment**

Risk of bias will be independently assessed by three reviewers using the SURGE guideline (PLoS Med 2011; 8: e1001069) .

**Strategy for data synthesis**

A narrative synthesis of the results obtained from the included studies will be undertaken, together with a metasummary of relevant findings.

**Analysis of subgroups or subsets**

An analysis by geographical area of the studies will also be performed.

**Dissemination plans**

Presentation at a relevant meeting and publication.

**Contact details for further information**

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**Collaborators**

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**Anticipated or actual start date**

02 December 2014

UNIVERSITY of York
Centre for Reviews and Dissemination

NHS
National Institute for Health Research

**Anticipated completion date**
02 March 2015

**Funding sources/sponsors**
Fundación Ramón Domínguez. "Convocatoria de axudas á investigación 2014"

**Conflicts of interest**
None known

**Language**
Spanish

**Country**
Spain

**Subject index terms status**
Subject indexing assigned by CRD

**Subject index terms**
Health Knowledge, Attitudes, Practice; Humans; Periodontal Diseases; Risk Factors

**Stage of review**
Ongoing

**Date of registration in PROSPERO**
12 January 2015

**Date of publication of this revision**
12 January 2015

| Stage of review at time of this submission | Started | Completed |
|---|---|---|
| Preliminary searches | Yes | Yes |
| Piloting of the study selection process | Yes | No |
| Formal screening of search results against eligibility criteria | No | No |
| Data extraction | No | No |
| Risk of bias (quality) assessment | No | No |
| Data analysis | No | No |

**Annex 3. STROBE statement**

https://www.strobe-statement.org/fileadmin/Strobe/uploads/checklists/STROBE_checklist_v4_combined.pdf

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

| | Item No | Recommendation |
|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found |
| **Introduction** | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses |
| **Methods** | | |
| Study design | 4 | Present key elements of study design early in the paper |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group |
| Bias | 9 | Describe any efforts to address potential sources of bias |
| Study size | 10 | Explain how the study size was arrived at |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding |
| | | (*b*) Describe any methods used to examine subgroups and interactions |
| | | (*c*) Explain how missing data were addressed |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy |
| | | (*e*) Describe any sensitivity analyses |
| **Results** | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed |
| | | (b) Give reasons for non-participation at each stage |
| | | (c) Consider use of a flow diagram |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders |
| | | (b) Indicate number of participants with missing data for each variable of interest |
| Outcome data | 15* | Report numbers of outcome events or summary measures |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included |
| | | (*b*) Report category boundaries when continuous variables were categorized |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses |

| | | |
|---|---|---|
| **Discussion** | | |
| Key results | 18 | Summarise key results with reference to study objectives |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results |
| **Other information** | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based |

*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

## Annex 4. Questionnaire

# CUESTIONARIO SOBRE ALERTA EP

Facultad de Medicina y Odontología
Departamento de Estomatología

(1) ZONA: C(1) L(2) O(3) P(4)
(2) Nº ENCTA:

Buenos días, soy alumno/a de la Facultad de Medicina y Odontología de la Universidad de Santiago de Compostela. Estamos haciendo una encuesta muy breve (4 minutos) sobre enfermedades de la boca, y le agradecería que me contestase a unas preguntas. Las respuestas son anónimas, y nunca se podrá saber quién contestó las preguntas.

PREGUNTA FILTRO: ¿Vive Vd. en **Galicia**? Sí (CONTINUAR) No (AGRADECER Y TERMINAR ENCUESTA)

En primer lugar, nos gustaría saber algunas cosas sobre usted: (MARCAR CON ASPA LA RESPUESTA)

**1.** (3). **Sexo**: Hombre (1) Mujer (2)

**2.** (4). Grupo de **Edad**:

| 18-34 | 35-44 | 45-64 | 64+ |
|---|---|---|---|
| (1) | (2) | (3) | (4) |

→ **COMPROBAR** EN HOJA DE RECUENTO SI EL **CUPO** DE EDAD ESTÁ YA CUBIERTO. SI FUERA ASÍ: AGRADECER Y TERMINAR

Ahora le voy a hacer unas preguntas sobre enfermedades de la boca

**3**. ¿Qué **enfermedades** de la boca **conoce**? (ANOTAR POR ORDEN Y PARAR EN 4, SI SE LLEGA)

1. .....
2. .....
3. .....
4. .....

(5) EP Sí (1) No (2) (6) Puesto 1-4

**4a** (7). ¿Ha oído hablar de la **periodontitis**? (SI YA LA HA MENCIONADO, MARCAR AQUÍ (1), E IR A PREGUNTA 6)
Sí (1) (IR A LA PREGUNTA 6) No (2)

**4b** (8). ¿Ha oído hablar de la **piorrea**? (SI YA LA HA MENCIONADO, MARCAR AQUÍ (1), IR A PREGUNTA 6)
Sí (1) No (2)

**IR A EXPLICACIÓN** (**SI** RESPONDIÓ **NO A** PREGUNTA **4A Ó 4B**):

**5.** (9). Periodontitis es un nombre más moderno y preciso que piorrea, pero los dos se refieren a **la misma** enfermedad. ¿Se **da cuenta** ahora de qué enfermedad hablamos?
Sí (1) (PASAR A PREGUNTA 6) No (2) (IR A EXPLICACIÓN)

**EXPLICACIÓN**:

"Es una enfermedad que se define como la inflamación de encías y de los tejidos que rodean los dientes, y se caracteriza por la destrucción de los ligamentos que sujetan los dientes y del hueso en que se apoyan."

(**AGRADECER SU PARTICIPACIÓN, TERMINAR LA ENTREVISTA Y DESPEDIR**)

**6.** (10). ¿**Cuál** cree que es la **causa**? (**NO** EVOCAR. MARCAR EL QUE DIGA)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Herencia | (1) | Alcohol | (3) | Bacterias | (5) | Otros (7) | |
| Edad | (2) | Tabaco | (4) | Mala higiene | (6) | | |

**7.** (11). ¿Las personas que tienen **periodontitis** tienen más **probabilidades de** tener **otras enfermedades?**
No (2) Ns/Nc (3) Sí (1)

**8.** ¿Cuáles? (12):

**9**. Por favor, díganos si la **periodontitis se relaciona con alguno** de estos problemas de salud:

| Problema | | Sí (1) | No (2) | Problema | | Sí (1) | No (2) |
|---|---|---|---|---|---|---|---|
| Quedarse sin dientes | (13) | | | Diabetes | (16) | | |
| Daño en el hueso de los maxilares | (14) | | | Parto prematuro | (17) | | |
| Infarto de miocardio | (15) | | | | | | |

**10**. De estos factores, ¿**cuáles** cree que **influyen** en que aparezca la periodontitis?

| Factor | | Sí (1) | No (2) | Factor | | Sí (1) | No (2) | Factor | | Sí (1) | No (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Herencia | (18) | | | Higiene | (20) | | | Tabaco | (22) | | |
| Edad | (19) | | | Bacterias | (21) | | | Diabetes | (23) | | |

**11.** (24). ¿De qué forma cree que **se nota** la periodontitis?
**NO** EVOCAR. MARCAR LOS QUE DIGA

| | |
|---|---|
| NS/NC | (1) |
| Encías rojas | (2) |
| Sangrado de encías | (3) |
| Movilidad de dientes | (4) |
| Encías retraídas | (5) |
| Caída de dientes | (6) |
| Comida entre dientes | (7) |
| Sensibilidad en los dientes | (8) |
| Otros (9) | |

**12**. Para terminar, nos gustaría saber **si está de acuerdo** o no con las siguientes frases:

| | | |
|---|---|---|
| a (25). La periodontitis no se puede prevenir | Acuerdo (1) | Desacuerdo (2) |
| b (26). No se puede evitar que aparezca sarro en la boca | Acuerdo (1) | Desacuerdo (2) |
| c (27). La periodontitis no tiene tratamiento | Acuerdo (1) | Desacuerdo (2) |
| d (28). Es normal que las encías sangren un poco al cepillar | Acuerdo (1) | Desacuerdo (2) |
| e (29). Las limpiezas de boca estropean los dientes | Acuerdo (1) | Desacuerdo (2) |

**13**. ¿Podría decirnos **qué usa** para lavar la boca? (**NO** EVOCAR. MARCAR LO QUE DIGA Y PREGUNTAR FRECUENCIA)

| | | | | |
|---|---|---|---|---|
| Cepillo de dientes (30) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Hilo dental (31) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Cepillo interdental (32) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Colutorios (33) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Cepillo eléctrico (34) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Irrigador (35) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |
| Limpiador lingual (36) | A diario (1) | A veces (2) | A la semana (3) | Nunca (4)* |

*LOS QUE **NO MENCIONE** SE CONSIDERARÁN COMO **NUNCA**

**14.** (37). ¿Le **sangran** las encías? Sí (1) No (2) No sabe (3) No tengo dientes (4)

**15.** (38). ¿Se le **mueve** algún **diente**? Sí (1) No (2) No sabe (3) No tengo dientes (4)

**16** (39). ¿Cada cuánto tiempo va al **dentista**? 6 meses (1) Al año (2) Cuando duele (3) Cuando hace falta (4)

Para dar sentido a esta información, necesitamos saber más sobre Vd. Podría decirnos si…

**17.** (40). ¿**Fuma**? Sí (1) No (2) Exfumador (3)

→ **18**. (41) ¿Cuánto?

**19.** (42). ¿Qué **estudios** ha **completado**? Obligatoria (1) Bachillerato (2) FP (3) Título universitario (4)

**20.** (43). ¿Cuál es su **situación laboral**?

| | | |
|---|---|---|
| Estudiante (1) | Cuidado familia/casa (4) | Funcionario (7) |
| Paro (2) | Trabaja a tiempo parcial (5) | Incapacidad permanente (8) |
| Jubilado (3) | Trabaja a tiempo completo (6) | Otros (9) ESPECIFICAR |
| | | |

**AGRADECER PARTICIPACIÓN Y DESPEDIR**

## Annex 5. Report from the Committee of Ethics in Research

The research protocol was approved by the Santiago-Lugo Committee on Research Ethics (#2014/600).

XUNTA DE GALICIA
CONSELLERÍA DE SANIDADE
Secretaría Xeral Técnica

Secretaria Técnica
Comité Autonómico de Ética da Investigación de Galicia
Secretaria Xeral. Consellería de Sanidade
Edificio Administrativo San Lázaro
15703 SANTIAGO DE COMPOSTELA
Tel: 881 546425; ceic@sergas.es

galicia

## DITAME DO COMITÉ DE ÉTICA DA INVESTIGACIÓN DE SANTIAGO-LUGO

Juan Manuel Vázquez Lago, Secretario do Comité de Ética da Investigación de Santiago-Lugo

**CERTIFICA:**

Que este Comité avaliou na súa reunión do día 17/12/2014 o estudo:

**Título:** Conocimientos sobre cáncer oral y enfermedad periodontal en Galicia
**Promotor**: Pablo Ignacio Varela Centelles
**Tipo de estudo:**Outros
**Versión:**
**Código do Promotor**:
**Código de Rexistro**: 2014/600

E, tomando en consideración as seguintes cuestións:

- A pertinencia do estudo, tendo en conta o coñecemento dispoñible, así coma os requisitos legais aplicables, e en particular a Lei 14/2007, de investigación biomédica, o Real Decreto 1716/2011, de 18 de novembro, polo que se establecen os requisitos básicos de autorización e funcionamento dos biobancos con fins de investigación biomédica e do tratamento das mostras biolóxicas de orixe humana, e se regula o funcionamento e organización do Rexistro Nacional de Biobancos para investigación biomédica, a ORDE SAS/3470/2009, de 16 de decembro, pola que se publican as Directrices sobre estudos Posautorización de Tipo Observacional para medicamentos de uso humano, e a Circular nº 07/2004, investigacións clínicas con produtos sanitarios.
- A idoneidade do protocolo en relación cos obxectivos do estudo, xustificación dos riscos e molestias previsibles para o suxeito, así coma os beneficios esperados.
- Os principios éticos da Declaración de Helsinki vixente.
- Os Procedementos Normalizados de Traballo do Comité.

Emite un **INFORME FAVORABLE** para a realización do estudo **polo/a investigador/a do centro**:

| Centros | Investigadores Principais |
|---|---|
| C.S. Praza do Ferrol | Pablo Ignacio Varela Centelles |

En Santiago de Compostela, a 18 de decembro de 2014
O secretario

Juan M. Vázquez Lago

DE ASIS A COMPOSTELA · 1214 · 2014 ·

## Annex 6. Research Funding

Fundación Ramón Domínguez I+D+i biosanitaria

CONVOCATORIA DE AYUDAS DE PROYECTOS DE INVESTIGACIÓN BIOMÉDICA EN LA XERENCIA DE XESTIÓN INTEGRADA DE LUGO, CERVO E MONFORTE

**Resolución del Comité de Evaluación de las Ayudas de Proyectos de Investigación Biomédica en la Xerencia de Xestión Integrada de Lugo, Cervo y Monforte.**

De acuerdo con las bases de la convocatoria, se constituye el Comité de Evaluación el día 07 de noviembre de 2014, formado por los siguientes miembros:

- José Castillo Sánchez, Director Científico del Instituto de Investigación Sanitaria de Santiago (IDIS), Presidente.
- Mª Rosaura Leis Trabazo, nombrada por el Presidente de la Comisión.
- Juan Jesús Gómez-Reino, nombrado por el Presidente de la Comisión.
- Felipe Casanueva Freijo, nombrado por el Presidente del patronato de la Fundación Ramón Domínguez.
- Fernando Fernández Lamela, nombrado por el Vice-Presidente de la Fundación Ramón Domínguez.
- María Gómez-Reino Garrido, Directora de la Fundación Ramón Domínguez, Secretaria.

Una vez analizada toda la documentación aportada por los candidatos y consideradas las evaluaciones individuales y consensuadas de los miembros de la comisión, se decide por unanimidad conceder las ayudas a los siguientes candidatos:

| CANDIDATOS | TÍTULO DEL PROYECTO | PUNTUACIÓN TOTAL |
|---|---|---|
| Carlos González Juanatey | Utilidad de la ecografía carotidea en el diagnóstico de enfermedad arterial coronaria y su posible valor pronóstico en pacientes con dolor torácico sometidos a ecocardiografía de esfuerzo. | 103,8 |
| Pablo Ignacio Varela Centelles | Conocimientos sobre cáncer oral y enfermedad periodontal en Galicia. | 90,2 |
| Rafael Golpe Gómez | Repercusión cardiovascular y respiratoria de la exposición al humo de biomasa (estudio LAREIRA). | 80,4 |

Santiago de Compostela, 25 de noviembre de 2014

idis Instituto de Investigación Sanitaria SANTIAGO DE COMPOSTELA

José Castillo Sánchez
Director Científico IDIS
Presidente de la Comisión de Evaluación

Fundación Ramón Domínguez

María Gómez-Reino Garrido
Directora Fundación Ramón Domínguez
Secretaria de la Comisión de Evaluación

## Annex 7. Secondary products from this PhD project

Artículos originales

# Conciencia sobre periodontitis entre el público general: *una revisión sistemática crítica para identificar brechas en el conocimiento*

Pablo Varela-Centelles*†; Pedro Diz-Iglesias†; Ana Estany-Gestal‡; Juan M. Seoane-Romero†; Rosendo Bugarín-González* and Juan Seoane†

**Antecedentes:** La pobre conciencia sobre la enfermedad periodontal y sus consecuencias ha sido reportada como la razón más frecuente de fracaso de tratamiento en la comunidad. Este estudio apunta a identificar las brechas más importantes en el conocimiento sobre Enfermedad Periodontal dentro del público general y averiguar si éstas son consistentes culturalmente.

**Métodos:** Las búsquedas sistemáticas fueron llevadas a cabo en las bases de datos EMBASE, PubMed, and SciELO (1998 a Noviembre 2014). La estrategia de búsqueda fue "periodontitis o enfermedad periodontal" y "conocimiento o conciencia) como palabras clave y texto libre. Los artículos fueron incluídos si reportaban sobre comunidades, estudios cuantitativos en individuos adultos.

**Resultados:** Un total de 2330 referencia fueron identificadas (1567 artículos) y seis artículos fueron finalmente seleccionados. La información fue dividida en nueve dimensiones de conocimiento periodontal: 1) conciencia, 2) etiología, 3) riesgos asociados, 4) signos y síntomas, 5) factores de riesgo, 6) tratamiento, 7) conocimiento general, 8) prevención y 9) actitudes. Esta clasificación reconoció conciencia de la enfermedad (80%), etiología (75%) y riesgos relacionados (71,43%) como los déficits más importantes del conocimiento dentro del público general. Estos hallazgos fueron confirmados mediante análisis.

**Conclusiones:** El número disponible de investigaciones basadas en la comunidad sobre conocimiento periodontal es escaso y restringido a áreas con un muy alto nivel de desarrollo humano. Las brechas de conocimiento existen en todas las áreas geográficas, con mayor relevancia sobre la baja conciencia y el pobre conocimiento sobre la etiología de las enfermedades periodontales y su relación con desórdenes sistémicos. Estos resultados destacan la necesidad de investigaciones locales, basadas en la comunidad sobre el conocimiento periodontal y las barreras que impiden el diagnóstico temprano, así como para intervenciones adecuadas centradas en estos temas. J Periodontol 2016; 87: 403-415.

**Palabras Clave:** Conocimiento de la salud, actitudes y práctica. Promoción de la salud; enfermedades periodontales; periodontitis; población; revisión.

**Dra. NATALIA ASQUINO**
*Docente Grado Uno. Facultad Odontología Universidad de la República del Uruguay.*

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Semergen. 2016;xxx(xx):xxx–xxx

Medicina de Familia
SEMERGEN
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TRABAJANDO JUNTOS

# Actualización en medicina de familia: patología periodontal

**M.C. López Silva[a], P. Diz-Iglesias[b], J.M. Seoane-Romero[b], V. Quintas[b], F. Méndez-Brea[c] y P. Varela-Centelles[a,b,*]**

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Recibido el 3 de febrero de 2016; aceptado el 5 de febrero de 2016

**PALABRAS CLAVE**
Enfermedad periodontal;
Revisión;
Medicina de familia;
Atención primaria

**Resumen** En España entre el 85-94% de la población mayor de 35 años sufre algún problema de las encías, y entre el 15-30% padece periodontitis, siendo las formas severas un 5-11% de los casos. A diferencia de otras entidades inflamatorias, la enfermedad periodontal rara vez causa molestias, limita la vida o causa alteraciones funcionales hasta que la enfermedad progresa y aparecen signos clínicos (recesión gingival, migración patológica de los dientes, movilidad) en estadios avanzados de la enfermedad. El desconocimiento de la enfermedad, ligado con la falsa creencia de que la pérdida dentaria es una causa inexorable de la edad, repercute en un diagnóstico tardío, requiriendo enfoques del tratamiento más complejos y con un peor pronóstico.

En el ámbito de la medicina de atención primaria hay una serie de fármacos asociados con la enfermedad periodontal, con la presencia de agrandamiento gingival (anticonvulsivantes, inmunosupresores y bloqueadores de los canales del calcio) como efectos secundarios, con variabilidad en cuanto a su presencia y severidad en función de la cantidad de placa acumulada. El estrés y la depresión son estados que alteran la respuesta del sistema inmune y aumentan la respuesta inflamatoria, incrementando la susceptibilidad de la periodontitis.

Asimismo, se han asociado una serie de enfermedades sistémicas a la periodontitis, entre las que se encuentran la diabetes mellitus, la enfermedad cardiovascular, las enfermedades respiratorias y las complicaciones de la gestación.


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**KEYWORDS**
Periodontal diseases;
Review;
Primary care;
Family physician

**Update in family medicine: Periodontal disease**

**Abstract** About 85-94% of the Spanish adults older than 35 experience gum problems, and about 15-30% suffer from periodontitis, being severe in up to 5-11% of them. Unlike other inflammatory conditions, periodontal disease rarely causes discomfort, or limits life or causes functional limitations until its advanced stages, when clinical signs and symptoms arise (gingival recession, pathological teeth migration, or mobility). Lack of knowledge about the disease, together with the idea that tooth loss is linked to ageing, frequently results in a late diagnosis, requiring extensive treatments with a worse prognosis.

At Primary Care level, there is series of drugs have been related to periodontal disease (anticonvulsants, immunosuppressive drugs, and calcium channel blockers) as secondary effects, which vary as regards their frequency and severity depending of the amount of accumulated plaque. Stress and depression have also been reported to alter the immune response and to increase the inflammatory response as well as periodontal susceptibility.

Certain systemic conditions, such as diabetes mellitus, cardiovascular disorders, respiratory diseases, as well as low-weight pre-term birth, have also been linked to periodontitis.


## Introducción

### Concepto

El glosario de términos periodontales de la Asociación Americana de Periodoncia, define la(s) enfermedad(es) periodontal(es) (EP) como «una inflamación de los tejidos de soporte del diente. Usualmente un cambio destructivo progresivo que lleva a la pérdida de hueso y ligamento periodontal. Una extensión de la inflamación de la encía al hueso y ligamento adyacentes»[1]. Ello es así porque el periodonto (aparato de soporte del diente compuesto por la encía propiamente dicha, el ligamento que une el diente al hueso, el propio hueso alveolar y el cemento radicular) puede verse afectado en distintas formas e intensidades en el marco común de un proceso inflamatorio.

La clasificación propuesta por Armitage[2], presentada en la tabla 1, resume la complejidad de la EP, haciendo hincapié en los posibles orígenes últimos de cada caso que nos pudiéramos encontrar en la consulta de atención primaria. De esta clasificación se deduce también que la afectación periodontal no siempre constituye un desorden con implicaciones exclusivas en la cavidad oral, sino que en ocasiones está relacionada con un problema sistémico, a cuyo diagnóstico temprano puede contribuir con la ayuda de una adecuada historia clínica.

A pesar de esta heterogeneidad, el término EP suele restringirse a las enfermedades inflamatorias más comunes causadas por placa bacteriana (un biofilm que incluye microflora patógena y se forma sobre la superficie del diente): la gingivitis y la periodontitis. La gingivitis es la forma más leve de afectación periodontal, y se caracteriza por estar circunscrita al tejido blando que rodea el diente y ser reversible mediante medidas de higiene oral adecuadas[3]. Cuando este proceso inflamatorio se extiende más profundamente y ocasiona pérdida de tejido conectivo y hueso alveolar se denomina periodontitis. En contra de lo que pudiera parecer, la gingivitis y la periodontitis no son un continuo, pues no todas las gingivitis evolucionarán a periodontitis ni estamos en condiciones de identificar aquellas que lo harán[4], si bien la periodontitis parece estar siempre precedida de gingivitis, pues no hay evidencias en la literatura que indiquen que pueda existir periodontitis sin inflamación gingival[5].

### Importancia de la enfermedad periodontal

Aunque existen evidencias que hacen sospechar la existencia de una infraestimación en la prevalencia de afección periodontal[6], la EP —en alguna de sus formas— afecta en torno al 90% de la población adulta mundial[7], con importantes variaciones geográficas. La prevalencia estimada de periodontitis ronda el 30%[8], mientras que la de las presentaciones más severas oscila entre el 6% en Canadá[9] y el 50% en Brasil[10]. En España, entre el 85% y el 94% de la población mayor de 35 años presenta algún problema relacionado con las encías, y entre el 15% y 30% sufre periodontitis, llegando a ser severa en el 5-11% de los casos[11]. Esto no es un fenómeno particular, sino que concuerda con lo que ocurre en otros países desarrollados, donde las formas más severas de periodontitis no suelen afectar a más del 10% de la población, mostrando patrones de progresión que parecen ser compatibles con la conservación de una dentición funcional durante toda la vida del paciente[12]. Por lo tanto, la pérdida de dientes por afectación periodontal a edades avanzadas no es un fenómeno inevitable[13]. De hecho, existe un consenso en que la periodontitis severa ocurre en unos pocos dientes en una proporción relativamente pequeña de cada cohorte de edad, que aumenta a medida que los sujetos envejecen[14], mientras que una inflamación gingival moderada es común a muchos adultos. Sin embargo, la literatura atribuye una importancia creciente a la periodontitis como causa de pérdida dentaria en países desarrollados,

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**Tabla 1** Clasificación de las enfermedades periodontales

| |
|---|
| **Enfermedades gingivales** |
| *Causadas por placa bacteriana* |
| *Lesiones gingivales no causadas por placa bacteriana* |
| Enfermedades gingivales con un origen bacteriano específico (por ejemplo: *N. gonorrhea* y *T. pallidum*) |
| Enfermedades gingivales de origen vírico (por ejemplo: infección por virus herpes: gingivoestomatitis herpética primaria, herpes oral recurrente, infecciones varicela-zóster) |
| Enfermedades gingivales de origen micótico |
| Enfermedades gingivales de origen genético (por ejemplo: fibromatosis gingival hereditaria) |
| Manifestaciones gingivales de enfermedades sistémicas: |
| Desórdenes mucocutáneos: liquen plano, penfigoide, pénfigo vulgar, eritema multiforme, lupus eritematoso, desórdenes inducidos por fármacos |
| Reacciones alérgicas (por ejemplo: a níquel, dentífricos, aditivos de chicles o alimentos) |
| Lesiones traumáticas |
| Reacciones a cuerpo extraño |
| **Periodontitis crónica** |
| **Periodontitis agresiva** |
| **Periodontitis como manifestación de enfermedades sistémicas** |
| *Asociada a desórdenes hematológicos, como neutropenia adquirida y leucemias* |
| *Asociada a desórdenes genéticos, tales como:* |
| Neutropenia cíclica y familiar |
| Síndrome de Down |
| Síndromes de deficiencia de adhesión leucocitaria |
| Síndrome de Papillon-Lefèvre |
| Síndrome de Chediak-Higasihi |
| Síndromes histiocitarios |
| Enfermedad de almacenamiento del glucógeno |
| Agranulocitosis genética infantil |
| Síndrome de Cohen |
| Síndrome de Ehlers-Danlos |
| Hipofosfatasia |
| **Enfermedades periodontales necrosantes** |
| *Gingivitis ulcerativa necrosante* |
| *Periodontitis ulcerativa necrosante* |
| **Abscesos periodontales** |
| **Periodontitis asociadas a lesiones endodónticas** |
| **Condiciones o deformidades adquiridas o del desarrollo** |

como consecuencia de la observada disminución de la prevalencia de caries y ligero incremento de la EP[15].

La periodontitis es una «enfermedad social»[14], en tanto que es más prevalente entre los estamentos más desfavorecidos de la escala social, habiéndose demostrado un peso importante del género, estatus socioeconómico y educativo, o estado civil. Es también un problema de salud pública que requiere intervención desde el punto de vista poblacional, en tanto en cuanto cumple los 4 criterios principales establecidos para ello[14]: amplia distribución entre la población (o, en caso contrario, ser grave); consecuencias severas para el individuo o la comunidad, existencia de medios para prevenir, aliviar o curar la enfermedad y costes importantes para el individuo o la comunidad. En general, las intervenciones poblacionales pivotan sobre el control de la placa bacteriana y el fomento de hábitos de vida saludables.

## Etiología

Hoy en día existe un importante corpus de conocimiento que indica que la causa directa de la gingivitis y la periodontitis es la acumulación de placa bacteriana en la región cervical de los dientes y su extensión apical a lo largo de la superficie radicular[16]. Esta conclusión se inicia con los primeros estudios epidemiológicos que corroboraron la impresión clínica de que la presencia de placa bacteriana visible a la inspección se asocia a inflamación gingival[17]. Sin embargo estos datos —procedentes de estudios transversales— no permitían establecer relaciones causales, por lo que se emprendieron estudios longitudinales para establecer la secuencia temporal causa-efecto. El más relevante de esos estudios[18] consistió en pedir a 12 estudiantes de odontología que dejasen de cepillarse los dientes para permitir que la placa se acumulase en los márgenes gingivales: en todos los casos se hizo evidente una gingivitis, que desapareció al retomar la higiene oral rutinaria. Estudios similares encontraron que si después de interrumpir el cepillado se introducía un colutorio antiséptico la gingivitis no se establecía, lo que se interpretó como un origen bacteriano de la enfermedad.

Más adelante en el tiempo se analizó la relación topográfica entre placa bacteriana y respuesta inflamatoria desde el punto de vista histológico[19], poniéndose de manifiesto que cuando la placa se restringía a la corona clínica del diente la inflamación afectaba únicamente a los tejidos supragingivales, mientras que si se extendía dentro del surco gingival, la afectación era más extensa.

El siguiente paso en el proceso de establecer el origen de la EP implicó el uso de animales criados en un entorno estéril. En estas circunstancias el uso de ligaduras entre los dientes (forma habitual de provocar una gingivitis experimental) no resultaba en la aparición de gingivitis[20]. Además, cuando se aplicó placa dental humana en la encía de perros de experimentación, estos animales desarrollaron inflamación gingival[21], lo que se tomó como evidencia de que la EP está causada por la placa dental.

Sin embargo, estas evidencias chocaron con el hecho de que algunos pacientes son capaces de soportar grandes acumulaciones de placa sin sufrir destrucción periodontal, mientras que otros con menores cantidades muestran una importante afectación[22], lo que se resolvió aceptando que, si bien la placa es el agente causal fundamental, existen otros factores implicados. La etiología de la EP se planteó como un equilibrio entre la respuesta del hospedador y la virulencia de las bacterias, de modo que cualquier factor que aumente sus efectos o comprometa la respuesta del hospedador influirá y determinará la aparición de la enfermedad.

Llegado el momento de aislar un agente causal, el proceso encontró serias dificultades, llegándose a la conclusión de que la EP era ocasionada por la flora oral habitual[23] que

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en determinadas circunstancias aumentaba su virulencia[24], con lo que el tratamiento y la prevención debería orientarse hacia mantener una ecología bacteriana favorable a la salud gingival[25].

La composición del biofilm que constituye la placa bacteriana es compleja, habiéndose aislado más de 325 especies[26], y estimándose en más de 400 considerando las formas no cultivadas[27]. La relación de las principales especies bacterianas, su organización y su papel en el biofilm escapan a los objetivos de esta revisión, pero baste señalar que en periodontitis existe una predominancia de bacterias anaerobias, particularmente bacilos anaerobios gram negativos[28].

La asociación entre cálculo (sarro) y EP ha llevado a la conclusión errónea de que el cálculo es la causa directa de la enfermedad, cuando no es así. El cálculo es inerte[29] y actúa como un factor de retención de placa bacteriana, al igual que restauraciones defectuosas o aparatos de prótesis dental.

## Signos y síntomas

La gingivitis se caracteriza por un enrojecimiento e hinchazón de las encías, que sangran fácilmente al contacto, como pasa, por ejemplo, al cepillado[30]. Cuando esta inflamación se extiende la encía se separa de los dientes creando unos espacios entre ambos llamados «bolsas». En estas condiciones el epitelio que tapiza la bolsa, frecuentemente ulcerado, es la única barrera entre el biofilm bacteriano y el tejido conectivo, permitiendo el acceso de toxinas bacterianas y otros productos al torrente circulatorio[30]. Para tener una idea de la dimensión del problema, baste señalar que, en un paciente con periodontitis moderada, la superficie de la bolsa en contacto directo con la placa bacteriana es de unos 72 $cm^2$, aproximadamente el tamaño de la palma de la mano[31].

La EP rara vez causa incomodidad, limita la vida de relación, compromete la función, o afecta a la calidad de vida de la mayoría de los afectados[32], hasta que la enfermedad avanza llegando a causar recesión gingival, migración patológica de los dientes o movilidad que comprometa la función[33].

El diagnóstico de la periodontitis se basa en la inspección, en la exploración radiológica de los tejidos periodontales y en la medición de los espacios existentes entre los dientes y la encía. Estas mediciones se hacen en 6 sitios alrededor de cada diente, y en condiciones de salud las dimensiones oscilan entre 1 y 3 mm (surco periodontal), aumentando a medida que la enfermedad progresa para formar la llamada «bolsa periodontal»[34]. Se registra también la cantidad de placa, sangrado gingival o supuración. Estos datos son necesarios para diagnosticar la enfermedad, establecer un pronóstico y monitorizar la enfermedad, pues su progreso tiende a ser episódico y específico en cada parte de cada diente[35].

Para la exploración radiológica es preferible emplear una serie de radiografías intraorales tomadas empleando un posicionador, pues ofrecen una imagen detallada de las piezas y su aparato de inserción de forma reproducible.

## Prevención

Con frecuencia, el sangrado gingival es el único síntoma que percibe el paciente hasta que la movilidad de los dientes causa incomodidad. Este desconocimiento, unido a la creencia de que la pérdida de dientes es inevitable con la edad[36], suele hacer que el paciente demande atención en estadios avanzados de la enfermedad requiriendo tratamientos más complejos y con peor pronóstico. De hecho, la falta de información se ha considerado la principal causa de fracaso del tratamiento periodontal a nivel comunitario[4], estando el médico de atención primaria en una posición privilegiada para evitarlo.

La prevención de la EP pasa por el control de los factores de riesgo, siendo los más relevantes el hábito tabáquico y la placa bacteriana.

Se ha demostrado más allá de toda duda que la acumulación de placa ocasiona inflamación gingival, y que la eliminación de esa placa disminuye la inflamación[18], así que la eliminación diaria de la placa por el propio paciente es fundamental para la prevención y el tratamiento de la enfermedad, y ello se consigue mediante el cepillado, la higiene interdental y el control químico de la placa.

En cuanto al *cepillado*, se ha definido el cepillo de dientes ideal[37] como aquel que cuente con un mango del tamaño apropiado para la edad del usuario y su nivel de destreza, cuya cabeza es adecuada al tamaño de la boca del paciente, cuente con filamentos redondeados de nylon o poliéster de diámetro no superior a 0,23 mm, de consistencia suave, y con una disposición que favorezca la eliminación de placa en los espacios interproximales y a lo largo de la línea del margen gingival. Si bien es verdad que la mayoría de los pacientes suele cepillarse los dientes 2 o 3 veces al día, no es menos cierto que los resultados en términos de eliminación de placa suelen ser mejorables. En este sentido, aunque existen técnicas recomendables en casos de afectación periodontal (Bass o Bass modificada) suele ser más efectivo modificar la técnica de cepillado del paciente que enseñarle otra técnica completamente nueva[38]. En cuanto al tiempo de cepillado se ha demostrado que tiempos superiores a 2 min, empleando una técnica correcta, no aportan beneficios adicionales[39].

En la entrevista clínica suele surgir con frecuencia la cuestión del uso de cepillos eléctricos. Aunque existe una gran variedad de modelos en el mercado, los cepillos eléctricos actuales han demostrado eliminar más placa y en menos tiempo que el cepillado manual, específicamente los que cuentan con cabezales redondeados y pequeños que describen movimientos rotatorios y oscilantes[40].

En lo que a la *higiene interdental* se refiere, es necesario tener presente que los cepillos de dientes no limpian interproximalmente, y que la limpieza interdental es pobre en la mayoría de los sujetos[41]. El hilo dental, la forma más común de limpieza interdental, es la más indicada cuando la papila gingival ocupa todo el espacio interdental y no existe recesión. En estas condiciones, y usada adecuadamente, la seda dental penetrará hasta 3 mm subgingivalmente[38]. En situaciones contrarias, los cepillos interdentales han resultado ser superiores al hilo dental[42]. Una limpieza interdental adecuada cada 24 h ha demostrado ser suficiente para mantener la salud gingival[43].

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SEMERG-1045; No. of Pages 8 ARTICLE IN PRESS



Lamentablemente, muchos pacientes no consiguen eliminar adecuadamente su placa bacteriana por medios mecánicos, siendo necesario suplementar estas medidas con *agentes químicos*. La clorhexidina ofrece excelentes resultados en la reducción de los niveles de placa e inflamación, si bien sus conocidos efectos secundarios normalmente limitan su uso durante largos períodos. Los colutorios compuestos por aceites esenciales han probado ser también eficaces sin los efectos secundarios de la clorhexidina[38]. El triclosán, otro conocido antiséptico, ha resultado ser menos eficaz en forma de colutorio que cuando se emplea en dentífrico.

Los colutorios antisépticos son también una opción a valorar en pacientes médicamente comprometidos, discapacitados que no pueden mantener una higiene oral adecuada, sujetos con alto riesgo de caries o pacientes portadores de aparatología intraoral fija[44].

## Tratamiento

El tratamiento habitual de la EP inflamatoria está orientado hacia la eliminación de la placa bacteriana y otros factores, como el cálculo o restauraciones defectuosas, que favorecen su acumulación o dificultan la eliminación. La selección de la técnica a emplear depende en general de la localización de la placa y el cálculo y de lo avanzado de la enfermedad. Las técnicas más comunes son la *tartrectomía*, consistente en la eliminación de cálculo supragingival acompañada de un pulido de la superficie del diente para eliminar placa bacteriana y tinciones, y el *raspado y alisado* radicular, que busca eliminar la placa y el cálculo subgingivales, junto con el cemento radicular infiltrado por toxinas bacterianas[45].

El raspado y alisado radicular no tiene únicamente efectos clínicos (disminución del sangrado gingival y de la profundidad de sondaje), sino también microbiológicos, favoreciendo un incremento significativo de bacterias gram positivas. Esta modificación favorable de la flora bacteriana no es permanente, sino que existe una tendencia hacia la recolonización, en presencia de placa supragingival y gingivitis[46], por parte de especies patógenas que puede ser controlada o modulada por medidas de autocuidados adecuadas suplementadas con controles periódicos de esta enfermedad crónica.

En ocasiones no es posible acceder a toda la superficie radicular desde el interior de la bolsa periodontal, por accidentes morfológicos de los tejidos duros (anatomía radicular, arquitectura del hueso alveolar) o blandos (profundidad y forma de la bolsa), siendo necesario elevar un colgajo para llevar a cabo el tratamiento periodontal.

Teniendo presente la etiología bacteriana de la enfermedad, cabe plantearse si el empleo de antibióticos adecuados podría resolver igualmente el problema. El hecho es que la organización de la microbiota en un biofilm, junto con las características de la enfermedad, reducen mucho la utilidad de estos fármacos en el tratamiento periodontal, más allá de procesos agudos y de determinados casos específicos, en los que su uso estaría vinculado al tratamiento mecánico, y nunca de forma rutinaria.

## Cómo puede influir el médico de atención primaria en la enfermedad periodontal

Quizá uno de los signos periodontales más llamativos que se pudieran encontrar en la consulta de medicina de familia sea el agrandamiento gingival. Esta alteración con frecuencia se relaciona con efectos secundarios de fármacos. Se trata de una reacción adversa que no es dosis-dependiente, y no es predecible desde el punto de vista de las propiedades farmacológicas de los fármacos implicados, habiéndose descrito para fenitoína (aproximadamente 50% de los casos), ciclosporina (25-81% según estudios) y bloqueadores de los canales del calcio[47], con prevalencias entre el 5% y el 20% según el fármaco, siendo el verapamilo el menos frecuentemente implicado[48].

En general, el agrandamiento suele aparecer entre uno y 3 meses después de instaurado el tratamiento, siendo más frecuente en niños y en pacientes con una higiene oral deficiente[48]. Acostumbra a iniciarse como una hinchazón difusa en la zona interdental que progresa hasta aglutinarse. El aspecto general es nodular, y su tono varía en función del componente inflamatorio que presente. En ocasiones puede llegar a ser tan importante que comprometa la estética o incluso llegue a interferir con la masticación.

Aunque los efectos de los fármacos pueden ser reversibles en muchos pacientes una vez se interrumpe el tratamiento[49], y razonablemente controlables mediante una adecuada higiene oral, en muchos casos es preciso eliminar quirúrgicamente el exceso de tejido[47].

En el caso de pacientes sometidos a estrés ocupacional, depresión, o que afronten eventos vitales negativos, es más frecuente la aparición de EP[50–52], alcanzando frecuencias hasta 3 veces superiores en el caso de la depresión[51]. La plausibilidad biológica de esta relación se basa en el efecto del estrés sobre el sistema nervioso central, y la consiguiente liberación de cortisol, que causaría depresión de la respuesta inmune, incluyendo IgA secretora, IgG y función de los neutrófilos, favoreciendo la proliferación bacteriana y aumentado la respuesta inmune. Igualmente se liberaría adrenalina y noradrenalina, que afectarían a prostaglandinas y proteasas, que a su vez aumentarían la destrucción periodontal. Una alternativa a este modelo sugiere que los cambios de comportamiento asociados al estrés aumentarían ciertos factores de riesgo periodontales (mala higiene oral, tabaco, etc.), con un claro efecto en la salud periodontal[53]. Además del papel de la propia enfermedad, los fármacos más frecuentemente empleados en su tratamiento también ejercen efectos negativos sobre la salud periodontal, bien indirectamente en forma de hábitos parafuncionales[54] o mediante disfunción de las glándulas salivares[55].

Desde la aparición de los anticonceptivos orales se ha venido relacionando su empleo con aumentos en la prevalencia de afectaciones periodontales (gingivitis y posiblemente periodontitis) en diferentes estudios publicados a lo largo del siglo pasado[56]. Sin embargo, esos estudios, muchos con errores metodológicos, hacen referencia a formulaciones que no están en uso hoy en día. En la actualidad se emplean dosis considerablemente más bajas, con lo que la información reunida sobre el tema a lo largo de los años no sería necesariamente de aplicación. La evidencia disponible a

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SEMERG-1045; No. of Pages 8 ARTICLE IN PRESS



partir de estudios recientes (1990 en adelante), contemplada en su conjunto, parece indicar que las modernas presentaciones de estos fármacos no parecen aumentar el riesgo de gingivitis o periodontitis en estas pacientes[57], si bien ello no excluye la necesidad de una adecuada historia clínica para diagnosticar estas enfermedades.

## Cómo influye la enfermedad periodontal en la práctica médica de atención primaria

Al igual que otras áreas de la economía, en el periodonto pueden manifestarse enfermedades sistémicas, como infecciones herpéticas, alteraciones dermatológicas (pénfigo, penfigoide o liquen plano), hematológicas (leucemia, neutropenia, anemias), del sistema retículo-endotelial (histiocitosis X), enfermedades granulomatosas (tuberculosis, granulomatosis de Wegener) y neoplasias primarias o metastásicas[47], o intoxicaciones industriales. Un ejemplo típico de estas últimas lo constituye el saturnismo (intoxicación por plomo), en la que se presenta una banda negro-azulada de unos pocos milímetros de amplitud que sigue la encía marginal (ribete de Burton)[58].

En los últimos años se ha ido desarrollando un creciente corpus de conocimiento que avala la asociación entre infección periodontal y ciertas enfermedades sistémicas. Mucho del interés en este tema viene del «regreso» del concepto de infección focal, planteado en 1891[59], y «resucitado» por la contribución de los avances en microbiología, biología molecular, genética, inmunología, estadística y metodología de la investigación ocurridos desde entonces.

En general, esta asociación se propone como resultado de concebir la bolsa periodontal y los tejidos inflamados circundantes como un reservorio de productos bacterianos y mediadores de la inflamación que fluirían de forma continuada en la circulación sanguínea. Además, algunas enfermedades sistémicas comparten con la periodontitis factores de riesgo y mecanismos etiológicos que podrían explicar esta relación[60].

El esfuerzo investigador sobre este tema crece exponencialmente, pudiéndose identificar en la literatura 3 áreas especialmente relevantes: enfermedad cardiovascular, enfermedad respiratoria, diabetes mellitus y gestación.

En el caso de las *enfermedades cardiovasculares* se ha hipotetizado que compartirían un mismo mecanismo causal con la periodontitis por medio de un fenotipo hiperinflamatorio, con liberación aumentada de citoquinas inflamatorias y otros mediadores[60], del tipo de proteína C reactiva, TNF-alfa, PGE, IL-1beta, e IL-6 que podrían acelerar la progresión de placas ateroescleróticas preexistentes[61]. La investigación en modelos experimentales y estudios clínicos apunta hacia la presencia de una asociación entre periodontitis y ACV, y también —aunque en menor medida— con la enfermedad arterial periférica, aunque no se puede afirmar una relación causal directa entre ambas. Sin embargo, y dadas las implicaciones de estos eventos vasculares, se recomienda instaurar protocolos preventivos y terapéuticos frente a infecciones periodontales[62]. Para el infarto agudo de miocardio se ha sugerido, como mecanismos adicionales, el daño endotelial directo y la activación de la coagulación. La mayor parte de los estudios observacionales describen asociaciones significativas, principalmente en individuos jóvenes y en aquellos con mayor afectación periodontal, sin embargo no hay ensayos clínicos que permitan considerar la periodontitis como un factor de riesgo independiente de enfermedades coronarias[63].

Para las *enfermedades respiratorias* la relación estribaría en la aspiración de placa bacteriana colonizada por patógenos respiratorios, que se adheriría al epitelio bronquial o alveolar[64]. La literatura muestra una asociación moderada de la periodontitis con neumonía, y débil con EPOC[65], aunque una higiene oral adecuada reduce la progresión de enfermedades respiratorias en sujetos mayores de alto riesgo.

La relación entre la *diabetes mellitus* (DM) y la periodontitis se considera bidireccional[66]: la diabetes favorece la infección oral que, una vez instaurada, agrava a su vez la DM. Esta relación se explicaría mediante la perpetuación de un estado de inflamación sistémica crónica evidenciado por el aumento de proteína C reactiva, IL-6, TNF-alfa y fibrinógeno, aumentando la resistencia a la insulina de un modo similar al que lo haría la obesidad[67]. Existe una creciente evidencia científica que sugiere que el tratamiento periodontal en diabéticos podría mejorar el control glucémico, además de disminuir la frecuencia de complicaciones derivadas de la DM, resultando ser la periodontitis un predictor de muerte por enfermedad isquémica cardíaca y de nefropatía diabética[68].

Las complicaciones de la *gestación* en las que se ha implicado a la periodontitis incluyen el bajo peso al nacer y el parto prematuro. La carga infecciosa materna en el tracto genitourinario y la vaginosis bacteriana se han identificado como factores contribuyentes, siendo la inflamación la vía común que resulta en contracciones uterinas y cambios cervicales, con o sin rotura prematura de las membranas[69], a lo que habría que añadir la contribución de la acción sobre el complejo placentario de productos bacterianos[70]. La plausibilidad biológica de esta relación descansa sobre 3 posibles vías[71,72]: diseminación hematógena de productos inflamatorios de la infección periodontal, respuesta inmune feto-maternal a los patógenos orales, o directamente de bacteriemia resultante de la infección oral.

Algunos estudios de casos y controles muestran que el parto prematuro es 7,5 veces más frecuente en mujeres con periodontitis severa[73]. A pesar de estos datos, la relación entre ambos no está clara, hasta el punto de que mientras algunos ensayos clínicos aleatorizados refuerzan la relación, con una OR de 4,7 (IC: 1,29-17,13)[74], otros descartan esa asociación[75]. Estas discrepancias se han atribuido a que los factores de riesgo de ambas condiciones pueden ser diferentes en distintas poblaciones, siendo necesario controlar por factores socioeconómicos, biológicos y ambientales en sucesivos estudios para eliminar factores de confusión[69].

## Conclusiones más relevantes

Durante las últimas décadas la investigación de la EP ha permitido el entendimiento tanto de los factores etiológicos como de su etiopatogenia, así como el desarrollo de tratamientos eficaces para frenar la progresión de la misma. Sin embargo, la ausencia de una sintomatología evidente (no causa dolor) permite largo tiempo de evolución sin tratamiento.

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SEMERG-1045; No. of Pages 8 ARTICLE IN PRESS



Además, se ha asociado la periodontitis a una serie de enfermedades muy prevalentes en la población, entre ellas la diabetes, la enfermedad cardiovascular y las enfermedades respiratorias, así como con complicaciones en la gestación. Por estos motivos el médico de atención primaria tiene un papel importante que desempeñar en la prevención y control de la EP.

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## Conflicto de intereses

Los autores declaran no tener ningún conflicto de intereses.

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## Annex 8. Original articles

The four original articles included in this PhD work.

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Review

# Periodontitis Awareness Amongst the General Public: A Critical Systematic Review to Identify Gaps of Knowledge

**Pablo Varela-Centelles,*† Pedro Diz-Iglesias,† Ana Estany-Gestal,‡ Juan M. Seoane-Romero,† Rosendo Bugarín-González,* and Juan Seoane†**

**Background:** Poor awareness of periodontal diseases and their consequences has been reported as the most frequent reason for periodontal treatment failure on a community basis. This study aims to identify the most relevant gaps of knowledge about periodontal diseases among the general public and to disclose whether these gaps are culturally consistent.

**Methods:** Systematic searches were conducted of the EMBASE, PubMed, and SciELO databases (1998 to November 2014). The search strategy was "periodontitis OR periodontal disease" and "knowledge OR awareness" as keywords and free text. Papers were included if they reported on community-based, quantitative studies undertaken on adult individuals.

**Results:** A total of 2,330 references were identified (1,567 single papers), and six papers were finally selected. Raw data were grouped into nine dimensions of periodontal knowledge: 1) awareness; 2) etiology; 3) associated risks; 4) signs and symptoms; 5) risk factors; 6) treatment; 7) general knowledge; 8) prevention; and 9) attitudes. This classification recognized disease awareness (80%), etiology (75%), and periodontal-related risks (71.43%) as the most important knowledge deficits among the general public. These findings were confirmed by weighted data analysis.

**Conclusions:** The number of available community-based investigations on periodontal knowledge is scarce and restricted to areas with a very high level of human development. Gaps of knowledge exist in every geographic area, with the most relevant issues of low awareness and poor knowledge about the etiology of periodontal diseases and their relation with systemic disorders. These results highlight the need for local, community-based investigations about periodontal knowledge and barriers hampering early diagnosis, as well as for adequate educational interventions focused on these issues. *J Periodontol 2016;87:403-415.*

**KEY WORDS**

**Health knowledge, attitudes, and practice; health promotion; periodontal diseases; periodontits; population; review.**

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Periodontal diseases (PDDs) are reported to be the second main cause of tooth loss among adults globally.[1] Mild to moderate periodontitis affects most adults,[2] and severe periodontitis is the sixth-most prevalent disorder worldwide, gradually increasing with age, with peaks at the third and fourth decades of life.[3] Reports from developed countries attribute to periodontitis an increasingly important part in future tooth loss as a consequence of decline in caries and slight increase in periodontitis prevalence.[4-6]

Disease severity is the result of a balance of bacteria–host interactions conditioned by inherited and environmental factors in predisposed individuals.[7] The natural history of periodontitis eventually results in tooth loss with sequels in mastication and speaking functions. Earlier signs of PDD may include gingival bleeding, which might progress toward gingival recession, mobility, and/or pathologic migration of teeth.[8] These events influence psychologic aspects, aesthetics, and quality of life.[9,10] PDDs are also related to systemic conditions, such as aspiration pneumonia, diabetes, cardiovascular conditions, ischemic stroke, or preterm birth.[11-13]

Gingivitis is considered a precondition for periodontitis,[14] although not all cases progress to periodontitis, nor it is possible to identify those that will.[15] Gingival bleeding is frequently the first and only symptom perceived by patients until tooth mobility causes discomfort. Periodontitis is

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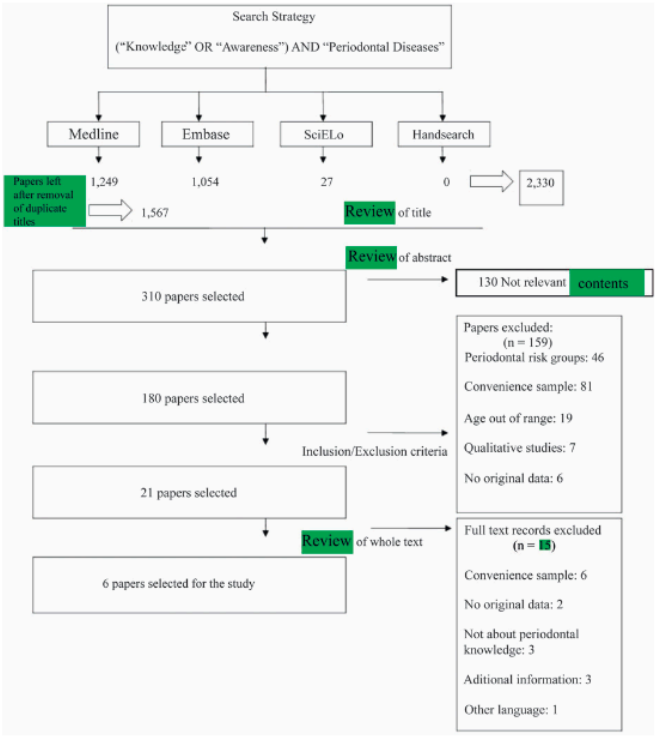


***Figure 1.***
*Flowchart of the study.*

related strongly to socioeconomic and behavioral variables,[16] including exposure to risk factors and self-care practices.

PDDs are controllable through adequate strategies involving both patients and clinicians, but prevention is the cornerstone of periodontal health.[15] Poor PDD awareness and the consequences have been reported as the most frequent reason for periodontal treatment failure on a community basis.[15] This lack of awareness often causes massive attachment breakdown until professional care is requested, amplified by the still existing belief that tooth loss is inexorably linked to aging.[17-20] Lack of awareness usually results in delayed PDD treatment, which is started at advanced stages requiring complex approaches and resulting in worse prognoses.

A necessary condition for improving health-related conducts is to have enough information about the actual deleterious behavior and why it should be modified.[21] An individual's beliefs also affect the outcome.[22] As stated by Croxson,[23] "in no aspect of Dentistry is it more important than in Periodontics for the patient to have knowledge, and for the dentist to understand what information the patient has when they come to the dental practice."

In this sense, the International Association for Dental Research includes in its research agenda the development of cross-cultural studies to identify socioeconomic factors that hinder the development and implementation of intervention strategies to prevent PDDs.[15,24,25]

The aim of this study is to identify the most relevant gaps of knowledge about PDDs among the general public and to disclose whether they are culturally consistent.

## MATERIALS AND METHODS

This review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines[26] and was registered in PROSPERO (International Prospective Register of Systematic Reviews; no. CRD42015015883).

Papers were included if they reported on cross-sectional, community-based, quantitative studies on adult individuals (maximum of 6% minors), providing original data about knowledge on PDDs, and were written in English, German, French, Italian, Portuguese, or Spanish languages. Publications on risk groups or reporting either on convenience samples or population subgroups in which a given level of health literacy could be presumed were excluded. This includes studies on patients with medical conditions because most require regular contact with a health care provider; these individuals may/should have received oral health counseling to increase their level of knowledge.

The EMBASE, PubMed, and SciELO databases were used to identify relevant papers published in the past 16 years (1998 to 2014), together with a hand search at the Galician network of university libraries. The search strategy was "periodontitis OR periodontal disease" and "knowledge OR awareness" as keywords and free text, and was undertaken in November 2014.

Two reviewers (PD-I and PV-C) independently searched the databases and reviewed both titles and abstracts. The results were discussed and merged into a single list, including potentially eligible articles

**Table 1.**
**Summary of Papers Reviewed**

| Study | Sampling | Intervention | Objectives | Primary Outcome | Secondary Outcome | Risk of Bias |
|---|---|---|---|---|---|---|
| Croxson, 1998, New Zealand[23] | Random; 500 people* throughout New Zealand | Telephone survey | To investigate changes in awareness and knowledge in population of New Zealand (implicit) | People are aware of cause of PDD; are less aware of disease in their own mouth as indicated by bleeding of gums, and do not seem concerned at such a problem when it does occur. | Lack of awareness and lack of concern; confusion about relation between etiology and issues of care | High |
| Lin et al., 2001, China[17] | Combination of multistage stratified sampling and quota sampling; 3,088 adults (1,522 males and 1,566 females, aged 35 to 44 and 65 to 74 years) in Southern China | Face-to-face interview | To describe oral health knowledge, attitudes, and practices of urban and rural adults in the area, and influence of various demographic and socioeconomic factors | Adults have poor oral health knowledge but positive attitudes toward oral health; some demographic and socioeconomic factors were found to influence patients' oral health knowledge, attitudes, and practices. | Low dental knowledge; lack of knowledge on PDD etiology and prevention | Low |
| Airila-Mansson et al., 2004, Sweden[29] | Random sampling from registry of inhabitants; 1,676 adults (828 males and 827 females, aged 31 to 40 years) in the Stockholm region | Self-applied questionnaire | To clarify association between self-reporting of PDD and outcome in a clinical examination and determine whether any difference is present in awareness of periodontal status between smokers and non-smokers | Participants who reported having PDD, especially those also reporting having movable teeth, were confirmed to have the disease; smokers were more aware of their periodontal status than non-smokers. | Most participants think they have PDD because of bleeding gums; one of most common reasons explaining periodontitis was "hereditary periodontitis." | Low |
| Mårtensson et al., 2004, Sweden[28] | Random sampling from a national population register; 900 individuals* (aged 50 to 75 years) | Mailed questionnaire | To investigate whether a mass media campaign regarding PDD could increase knowledge in general population of diagnoses, symptoms, and treatment options of PDD | Campaign probably was successful from public health knowledge standpoint. | Insufficient knowledge about PDD signs, symptoms, and treatments | Low |

**Table 1. (continued)**
**Summary of Papers Reviewed**

| Study | Sampling | Intervention | Objectives | Primary Outcome | Secondary Outcome | Risk of Bias |
|---|---|---|---|---|---|---|
| Deinzer et al., 2009, Germany[4] | Multistratified sample with area sampling (first step), random digit dialing (second step), and stochastic selection of interviewee; 1,001 individuals; 479 males and 522 females; aged >14 years | Telephone survey | To assess periodontitis-related knowledge and its relation to oral health behavior on a community level and to identify target groups and major topics for health education interventions | Health education on PDDs must be improved on a community level, although schoolchildren, older citizens, and the less educated are groups most in need; interventions should focus on preventive measures. | Knowledge deficits about definition of periodontitis, associated risks, periodontal risk factors, and preventive measures | Low |
| Gholami et al., 2014, Iran[30] | Stratified, multistage, random-area sampling; 791 adults (398 males and 393 females, aged 18 to 50 years) in Tehran | Face-to-face interview | To assess knowledge of and attitudes toward periodontal health among adults in Tehran | Poor periodontal knowledge and a generally positive attitude toward and great appreciation of periodontal health | Poor knowledge about etiology and signs and symptoms of PDDs; low awareness; good knowledge about oral hygiene; positive attitude | Low |

* Number of males and females in study unavailable.

and those whose abstracts provided unclear information. These publications were retrieved for full-text assessment and individually evaluated by both reviewers. Differences concerning eligibility were solved by consensus; when it was not attained, a third reviewer (JMS-R) was consulted. A flow chart of the study is represented in Figure 1.

The quality assessment was performed according to the criteria by Bennet et al.,[27] using 38 specifically designed items. Each item was verified, and its presence was recorded as "yes," absence as "no," and partially/unclearly present as "not clear." Articles scoring >50% of yes items were allocated a low risk for bias, whereas those scoring >50% of no were classified "high risk for bias." Any other circumstance was categorized as moderate risk.

Data extraction was undertaken independently by three reviewers (PD-I, AE-G, PV-C) using a purpose-made form[4,17,23,28-30] (Table 1).

PDDs were defined as "any inflammatory alteration of the gum (periodontium) in a dentate subject" to identify as many reports as possible. Gap of knowledge was defined as "the absence of answer, incorrect answer, or erroneous identification or definition given by 33% or more of the sample investigated in each study." Awareness was defined as the act of "taking account" of a state of affairs.[31]

The primary outcome of this study (PDD knowledge) was the percentage of right answers to each question/item in relation to wrong/do not answer/do not know responses for each question and study. A secondary outcome (dimensions of periodontal knowledge) was defined as the combined percentages of incorrect responses for each item related to the following dimensions: 1) awareness; 2) etiology; 3) associated risks; 4) signs and symptoms; 5) risk factors; 6) treatment; 7) general knowledge; 8) prevention; and 9) attitudes.

The prevalence of gaps of knowledge in each dimension is presented as a percentage of questions if a deficit was identified related to the total number of questions made to investigate a given dimension in all the reports included in this review.

To determine the relative importance (RI) of the gaps in each dimension, a mathematic formula was developed using the number of papers investigating each dimension (research priority), their methodologic quality ($Q$) (Table 2, headings Methods, Sample selection, and Research tool), the depth in which each dimension is explored (number of questions made), and the percentage of gaps of knowledge identified ($G$): $RI_d = \Sigma Q_n \times G_n$. This approach permits weighting the importance of each dimension in the whole periodontal knowledge (the more relevant, the more reports would have investigated it), the quality of each individual investigation, and the importance of the gaps of knowledge in each dimension in each study.

**Table 2.**
**Quality Assessment of Articles Considered**

| Criteria | Croxson[23] | Airila-Mansson et al.[29] | Deinzer et al.[4] | Gholami et al.[30] | Mårtensson et al.[28] | Lin et al.[17] |
|---|---|---|---|---|---|---|
| Justification of research method | Y | Y | N | N | N | N |
| Background literature review | Y | Y | NC | NC | NC | Y |
| Explicit research question | N | N | Y | N | Y | N |
| Clear study objectives | N | Y | Y | Y | Y | Y |
| Methods | | | | | | |
| Description of methods used for data analyses | N | Y | Y | Y | Y | Y |
| Method of questionnaire administration | Y | NC | Y | Y | Y | Y |
| Location of data collection | Y | Y | Y | Y | Y | Y |
| Dates of data collection | Y | Y | N | Y | Y | Y |
| Number and types of contact | N | Y | Y | Y | Y | Y |
| Methods sufficiently described for replication | N | NC | NC | Y | NC | Y |
| Evidence of reliability | N | N | Y | Y | N | NC |
| Evidence of validity | N | Y | Y | Y | N | NC |
| Methods for verifying data entry | N | N | N | N | N | Y |
| Use of codebook | N | N | N | N | Y | N |
| Sample selection | | | | | | |
| Sample size calculation | N | N | NC | Y | N | N |
| Representativeness | NC | Y | Y | Y | NC | NC |
| Method of sample selection | NC | NC | Y | Y | NC | Y |
| Description of population and sample frame | N | Y | Y | N | N | Y |
| Research tool | | | | | | |
| Description of research tool | N | NC | Y | Y | Y | Y |
| Description–development of research tool | N | N | Y | Y | N | N |
| Instrument pretesting | NC | N | Y | Y | N | Y |
| Instrument reliability and validity | N | N | Y | Y | N | N |
| Scoring methods | N | N | Y | Y | N | Y |
| Results | | | | | | |
| Results of research presented | Y | NC | Y | Y | Y | Y |
| Results address objectives | NC | Y | Y | Y | Y | Y |
| Clear description (result based on part sample) | Y | Y | Y | Y | N | Y |
| Generalizability | NC | NC | Y | Y | NC | NC |

**Table 2. (continued)**
**Quality Assessment of Articles Considered**

| Criteria | Croxson[23] | Airila-Mansson et al.[29] | Deinzer et al.[4] | Gholami et al.[30] | Mårtensson et al.[28] | Lin et al.[17] |
|---|---|---|---|---|---|---|
| Response rates | | | | | | |
| Response rates stated | N | Y | Y | Y | Y | N |
| How response rate was calculated | N | NC | NC | NC | N | N |
| Discussion of non-response bias | N | N | Y | N | Y | N |
| All respondents accounted for | NC | NC | N | Y | Y | Y |
| Interpretation and discussion | | | | | | |
| Interpret and discuss findings | Y | Y | Y | Y | Y | Y |
| Conclusions and recommendations | NC | Y | Y | Y | Y | Y |
| Limitations | N | N | N | Y | Y | N |
| Ethic and disclosure | | | | | | |
| Consent | N | NC | N | Y | NC | NC |
| Sponsorship | N | N | Y | Y | N | Y |
| Research ethic approval | N | N | N | Y | N | N |
| Evidence of ethical treatment of human participants | N | NC | NC | Y | Y | N |

Y = yes; N = no; NC = not clear.

## RESULTS

The search strategy yielded 2,330 references. After removing duplicates, 1,567 single citations were identified, and 310 of them were deemed relevant after assessing their titles. The abstracts of these papers were evaluated, and 130 were discarded because they were not relevant for the aims of this investigation. Another 46 were excluded for studying risk groups, 81 used convenience samples, 19 included a significant number (≥6%) of non-adult participants, seven were qualitative in nature, and six did not report on original data.

The full text of the remaining 21 papers was retrieved, and six additional reports were excluded for investigating convenience samples.[32-37] Three papers were discarded for focusing on other aspects of periodontology.[38-40] An additional set of two reports was precluded for using non-original data.[17,41] Another paper was rejected for language reasons,[42] and a final group of three reports was excluded because they provided additional information about studies already published in another journal.[43-45] Therefore, six papers were finally selected for this systematic review[4,17,23,28-30] (Fig. 1).

Although the information obtained from papers in systematic reviews is often limited by the methodologic flaws of the original investigations,[46] no reports were excluded for quality reasons.

A total of 7,945 individuals participated in the selected studies. Sample sizes ranged from 500 individuals[23] to 3,088 interviewees[17] and included individuals from three continents: Europe,[4,28,29] Asia,[17,30] and Oceania[23] (Table 1).

Most reports[4,17,28-30] showed an adequate quality and a low risk of bias, whereas only one[23] was found to be at high risk (Table 2).

Raw data from each study were used to identify gaps of knowledge about a question, and these questions were grouped into nine "dimensions" of periodontal knowledge. The grouping process and the results obtained are depicted in Table 3 to preserve the richness of the original data and to clarify the procedure.[47] Unfortunately, one paper[29] shows information about certain variables grouped under a common heading, and it was impossible to calculate raw data.

When all dimensions were considered, a higher percentage of knowledge deficits was identified in "periodontal awareness" (80%), followed by "PDD etiology" (75%). Less frequent gaps were disclosed in issues related to attitudes toward the disease (36.36%) and prevention (36.84%) (Table 4).

The methodologic quality of the selected papers (presence of the items detailed in Table 2 under the headings Methods, Sample selection, and Research tool) was expressed as a percentage divided by 10 and showed a wide variation among studies, ranging from 1.58[23] to 8.42.[30] Mårtensson et al.[28] and Airila-Mansson

**Table 3.**

## Gaps of Knowledge Identified in Literature

| Study | Item | Gap of Knowledge |
|---|---|---|
| Croxson[23] | Etiology | |
| | What causes gum disease? | Yes |
| | Awareness | |
| | If your gums bleed, does this worry you? | Yes |
| | Attitudes | |
| | If your gums bleed, what do you do about it? | Yes |
| Lin et al.[17] | Etiology | |
| | Perceived cause of gum disease | Yes |
| | Prevention | |
| | Perceived preventive methods for gum disease | Yes |
| | Regular visits to dentists prevent dental problems | No |
| | Attitudes | |
| | Just like birth, aging, and death, loss of teeth is a natural process. | Yes |
| | State of teeth is decided at birth and is not related to self-care. | Yes |
| | Poor teeth are detrimental to one's appearance. | No |
| | State of my teeth is of great importance to me. | No |
| | Keeping natural teeth is not important. | No |
| | Dental problems can affect the body as a whole. | No |
| | False teeth will be less of a bother than natural teeth. | No |
| Airila-Mansson et al.[29] | General aspects | |
| | Do you think you have periodontal disease? | No |
| | Signs and symptoms | |
| | Why do you think you have periodontal disease?: bleeding gums | Grouped data |
| | Why do you think you have periodontal disease?: mobile teeth | Grouped data |
| | Etiology | |
| | Why do you think you have periodontal disease?: hereditary periodontitis | Grouped data |
| Mårtensson et al.[28] | Signs and symptoms | |
| | Do you know which of the following troubles and symptoms may indicate that you suffer from caries or periodontitis? | Bleeding gums: no<br>Mobile teeth: no<br>Increased space between the teeth: no |
| | Treatment | |
| | Do you know which of the following types of treatments and examinations are intended for caries and periodontitis? | Scaling: no<br>Gingival surgery: no<br>Pocket probing: yes<br>x-Ray examination: yes |
| | Prevention | |
| | Careful dental hygiene | No |
| | Cleaning between the teeth | No |

**Table 3. (continued)**

**Gaps of Knowledge Identified in Literature**

| Study | Item | Gap of Knowledge |
|---|---|---|
| Deinzer et al.[4] | Etiology | |
| | Periodontal disease is caused by dental plaque. | No |
| | Awareness | |
| | In early stages, one recognizes periodontitis by frequent toothaches. | Yes |
| | General aspects | |
| | What is periodontitis? | Yes |
| | What is periodontitis? Five alternative answers | Yes |
| | Most frequent oral disease in adults is caries. | Yes |
| | Periodontitis often remains unrecognized for years. | No |
| | Not just older persons are susceptible to periodontitis. | No |
| | Untreated periodontitis will ultimately cause tooth loss. | No |
| | Related risks | |
| | People suffering from periodontitis have an increased risk for other disorders: do you know any of these disorders? | Yes |
| | Please assess whether patients with periodontitis have an increased risk for these diseases. | Myocardial infarction: yes<br>Tooth loss: no<br>Persistent damage of alveolar bone: no<br>Diabetes: yes<br>Preterm birth: yes |
| | Risk factors | |
| | Do you know any risk factors for periodontal disease? | Yes |
| | Please assess which of the following factors are risk factors for periodontitis. | Gingivitis: no<br>Dental calculus: no<br>Plaque bacteria: no<br>Nicotine consumption: yes<br>Stress: yes<br>Diabetes: yes |
| | Prevention | |
| | If one manages to sustain very good oral hygiene, he or she will not suffer from periodontitis. | No |
| | One cannot avoid emergence of dental calculus. | Yes |
| | To really get teeth clean by daily brushing, above all one has to brush them firmly. | No |
| | The fewest patients manage to sustain optimal oral hygiene without the help of their dentist. | No |
| | To avoid periodontitis, it is of particular importance to brush the chewing surfaces. | Yes |
| | Industry provides several devices for oral hygiene. Which of them are absolutely necessary to maintain good oral health? | Toothbrush: no<br>Toothpaste: yes<br>Interdental hygiene: no |

et al.[29] both scored 3.68, and Lin et al.[17] and Deinzer et al.[4] reached 6.32 and 7.37, respectively.

The application of the formula for RI of the lack of knowledge in each dimension highlighted the need for educational interventions about disease awareness and etiology and also revealed a weak knowledge about the relation between PDDs and systemic disorders (Fig. 2). The size of each point in the figure is related to the RI of each dimension in the deficit in periodontal knowledge considered as a whole.

**Table 3. (continued)**

**Gaps of Knowledge Identified in Literature**

| Study | Item | Gap of Knowledge |
|---|---|---|
| Gholami et al.[30] | General aspects | |
| | What is dental plaque? | No |
| | Awareness | |
| | Bleeding gums during brushing is normal. | Yes |
| | Despite any preventive care in relation to gum disease, I worry about getting the disease. | Yes |
| | Etiology | |
| | What causes gum disease? | Yes |
| | Signs and symptoms | |
| | How would you describe healthy gums? | Yes |
| | Which one is an early sign of gum disease? | Yes |
| | Which one is the outcome of progressed gum disease? | Yes |
| | Related risks | |
| | Which of the following systemic diseases affects progression of gum disease? | Yes |
| | Risk factors | |
| | Avoiding smoking prevents gum disease. | No |
| | Prevention | |
| | Mostly gum disease is preventable. | No |
| | Twice a day toothbrushing together with flossing is efficient in preventing gum disease. | No |
| | Regular dental visits can prevent gum disease. | No |
| | If I haven't eaten food, toothbrushing is not necessary. | Yes |
| | I believe that only in situations with pain or problems must I visit a dentist. | Yes |
| | In my opinion, scaling is harmful for gum health. | No |
| | Brushing with salt prevents gum disease. | Yes |
| | Attitudes | |
| | Undesirable gum status will affect people's work and their social relations. | No |
| | Oral and dental diseases are less important than other diseases. | No |
| | I don't like my teeth to appear longer than normal because of gum diseases. | Yes |

## DISCUSSION

The diagnosis of any disorder is the result of a chain of events in which patients and clinicians interact conditioned by the disease and the health system. The probabilities for a patient to seek clinical advice are related to that patient's perception that a given symptom will not disappear either by a natural process or through self-medication. This decision is highly dependent on the patient's sociocultural environment and health-related knowledge.[48] Assessing patients' knowledge about a disease is the cornerstone for undertaking successful community interventions for primary and/or secondary prevention. Although this evaluation has to be necessarily undertaken on a local basis, existing reports[4,17,23,28-30] point to a deficit of periodontal knowledge worldwide that seems to be independent from the geographic area and type of population studied. Most investigations are focused on convenience samples,[37,49,50] risk groups,[51,52] or population subsets defined by a particular feature,[53,54] and only a few reports provide information useful for interventions at a community level. In this sense, and to the best of the authors' knowledge, the present investigation is the first systematic review undertaken on this topic. Although knowledge is just a single aspect among a series of factors affecting health behavior, it can be considered a precondition of additional measures to improve oral health-related conducts.[4]

The quality assessment of the selected publications has permitted the identification of investigations at low risk of bias.[4,17,28-30] Approaches to the problem differ among studies, e.g., face-to-face interviews,[17,30] by phone,[4,23] self-administered in the waiting room,[29] or at

**Table 4.**

**Summary of Distribution of Gaps of Knowledge Identified in This Critical Systematic Review**

| Dimension | Studies Investigating Each Dimension | Depth of the Study (n questions) | Gaps of Knowledge, n (%) |
|---|---|---|---|
| Awareness | 4, 23, 30 | 5 | 4 (80%) |
| Etiology | 4, 17, 23, 29, 30 | 5* | 3 (75%) |
| Related risks | 4, 30 | 7 | 5 (71.43%) |
| Signs and symptoms | 28, 29, 30 | 8† | 3 (50%) |
| Risk factors | 4, 30 | 8 | 4 (50%) |
| Treatment | 28 | 4 | 2 (50%) |
| General aspects | 4, 29, 30 | 8 | 3 (37.5%) |
| Prevention | 4, 17, 28, 30 | 19 | 7 (36.84%) |
| Attitudes | 17, 23, 30 | 11 | 4 (36.36%) |

* One question was excluded because of absence of raw data.
† Two questions were excluded because of absence of raw data.

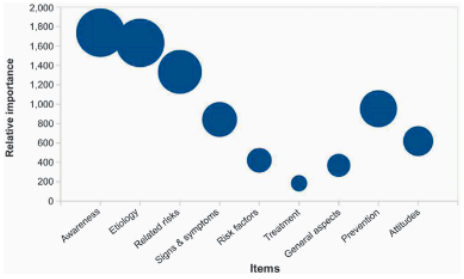


***Figure 2.***
*RI of gaps of knowledge for research and/or community interventions.*

the patients' home by mail,[28] with variations in the sampling method from multistratified[4,17,30] to simple random sampling.[28] These variations may have influenced response rates, reliability, and representability of the information obtained. However, the results obtained in this systematic review permit a helpful picture of the problem of periodontal knowledge at a community level.

There is also the issue of the wide variations in the questions made in the different studies; it can be argued that a gap of knowledge identified in a given dimension may not exist if a different question on the same topic were asked. It is presumed that each research group has designed their questions according to their sociocultural environment and the health literacy level they anticipate to be adequate for their particular setting.

Regarding the geographic origin of the papers, all areas had reached a "very high" level of human development when the investigations were undertaken: 1) Iran (Tehran), 0.942; 2) Germany, 0.911; 3) New Zealand, 0.910; 4) Sweden, 0.898; and 5) China (Guandong province), 0.891. The human development index includes three variables: 1) life expectancy at birth, 2) education, and 3) gross domestic product per capita.[55]

The definition of gap of knowledge (≥33% of wrong/blank responses) may seem inadequate when 100% correct answers to key questions would be desirable. However, this level of discrimination permits identifying areas in which interventions at a community level would be clearly justified.

None of the reports considered in this review investigate all nine dimensions defined for periodontal knowledge, and the depth to which a given dimension is explored (number of questions made) also varies among studies. These findings are interpreted as a prioritization strategy by the research groups to focus their efforts on those aspects of the problem they consider more important. However, more questions do not necessarily result in a more accurate image; perhaps a clear single question repeated in every study would offer more meaningful information.

The combination of both raw (plain percentages) and weighted data offers an interesting picture where the former finds "periodontal awareness," the dimension with a higher deficit of knowledge (80%), which is confirmed by the conclusions of one report[23] and supported by the weighted results (Fig. 2). The role of awareness in PDD control is well established, as well as

the need for an increase at a community level, because "no major improvements can be expected unless attitudes of society undergo essential changes."[56]

Raw and weighted results also agree in recognizing the deficit of knowledge about the etiology of PDDs as the second most relevant gap identified in scientific literature. This finding is somewhat shocking because the bacterial etiology of PDDs was established by the middle of the 20th century and may mean that periodontists and health professionals alike have failed in transmitting this key message to the general public, despite different health campaigns undertaken in various countries through the years.

It is worth mentioning the third position attained by the "related risks" dimension, which covers the relation between periodontal and systemic disorders. This dimension was investigated by the two studies with the highest scores in methodologic quality, and the RI allocated to this topic in this review is greatly attributed to this circumstance. The interest in periodontal medicine is relatively recent,[57] and this may have been the reason for not being considered by previous studies rather than because of a prioritization of the research effort. Therefore, the RI of the gap in this dimension may be more relevant than shown by the results.

The particular case of PDD prevention is also interesting because a paper[4] concludes that any intervention for improving periodontal knowledge should be focused on disease prevention. Conversely, the weighted results rank this need in a fourth position, and raw data classify it as the second to last (36.84%) to be fulfilled. The analysis of the results obtained by Deinzer et al.[4] seem to suggest that knowledge related to prevention (and not other topics) has a significant relation with self-reported health behavior. Thus, interventions focused on this matter could be more effective than those dedicated to other knowledge topics.

Because the results of any epidemiologic investigation depend on its methodologic soundness, the use of weighted data (RI) is more useful for selecting the periodontal knowledge dimensions to investigate in local studies, as well as for designing educative interventions about periodontal health. Interventions for oral health promotion are effective in changing people's knowledge.[27]

The knowledge–attitudes–practices health education model assumes that the only obstacle to making positive health choices is ignorance. Therefore, information alone can induce changes in behavior.[58] Unfortunately, knowledge is necessary but not sufficient for changing behavior,[59] although this model is still useful.[23,58,60-62]

Behavior modification in periodontics is a complex process, and no psychologic model proved to be better. Although the application of social cognition models to behavior-changing interventions is still in its infancy, they have been used repeatedly to predict health behavior changes.[63] The Health Belief Model includes five key beliefs for changing health behaviors: 1) perceived susceptibility to the disease; 2) perceived severity; 3) perceived barriers; 4) perceived benefits; and 5) health motivation. An additional component—cues to action—was included to account for any stimuli that might trigger behavior.[63]

Knowledge on periodontal risk factors and etiology may influence patients' perceived susceptibility. Information on periodontitis-related risks and knowledge on PDD general aspects and on their signs and symptoms can change the perceived severity of the disorder. Understanding periodontitis treatment may modulate perceived barriers for treatment, and information about prevention would highlight the perceived benefits of an adequate periodontal behavior. In the same way, positive attitudes would favor motivation, and an adequate awareness may act as a cue to action.

Moreover, oral health–compromising behaviors tend to cluster to each other, and they do not occur in isolation.[32] Thus, additional benefits could be expected from interventions for correcting the gaps in periodontal knowledge. Our results highlight the need for local, community-based investigations about periodontal knowledge.

## CONCLUSIONS

The number of available community-based investigations on periodontal knowledge is scarce and restricted to areas with a very high level of human development. These studies identify gaps of knowledge in every geographic area, with the most relevant being low awareness, poor knowledge about the etiology of PDDs, and their relation with systemic disorders.

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ORIGINAL ARTICLE

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# Primary care physicians and nurses: Targets for basic periodontal education

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**Abstract**

**Background:** Early diagnosis may improve patients' quality of life and reduce the lifelong social and financial burden inherent to treatment. Growing evidence supports the importance of a healthy periodontium in systemic health. Diagnosis depends on the patient and the healthcare professional. As many patients seek physicians' advice first, this study aims at assessing periodontal knowledge in a general population and their primary care physicians and nurses.

**Methods:** This is a cross-sectional study using an anonymous questionnaire applied to randomly selected laypersons (March to June 2016), and to physicians and nurses at their workplaces (October to December 2016) in Ourense, Spain. Sample size for the general population was determined by quota sampling.

**Results:** A total of 1,469 people entered the study. All healthcare workers and 624 (47.1%) laypersons were familiar with periodontitis. Bacterial etiology of periodontitis was recognized by 25 (4%) laypersons, 23 (34.3%) physicians, and 11 (16.6%) nurses. The following periodontal problems were experienced: 1) gingival redness: laypersons 14.4%, physicians 16.4%, and nurses 21.2%; 2) gingival bleeding: laypersons 22.2%, physicians 50.7%, and nurses 50%; 3) tooth mobility: laypersons 34.9%, physicians 7.4%, and nurses 6%; and 4) bleeding while toothbrushing: laypersons 44.3%, physicians 8.9%, and nurses 15.1%. More than a third of laypersons (37%) think periodontitis is related to other health problems, together with 53% of physicians and 47% of nurses.

**Conclusions:** Our results show a low degree of periodontal knowledge both amongst the public and their primary care physicians and nurses and unveil unreliable targets (primary healthcare workers) for educational interventions to improve early diagnosis and treatment of periodontal disorders.

KEYWORDS

early diagnosis, interprofessional education, laypersons, nurses, periodontitis, physicians, primary health care, primary prevention

  

## 1 | INTRODUCTION

Periodontal diseases (PDDs) are considered the second cause of tooth loss in adult populations worldwide,[1] and most adults are affected in some degree.[2] Although any disorder of the tissues supporting the teeth can fit within this term, it is usually restricted to the most common inflammatory disorders: gingivitis, a mild, reversible form; and periodontitis, an inflammation progressing deep into the teeth supporting tissues causing loss of attachment (support) of the teeth.[3] Though gingivitis is a precondition for periodontitis,[4] not all patients will have periodontitis, nor it is possible to identify which patients will.[5]

Early signs of chronic gingivitis include redness of the gingivae and mild bleeding during toothbrushing, and periodontitis is usually asymptomatic until it progresses to cause tooth migration, mobility, or tooth loss,[3,6] and their diagnosis rely on clinical and radiographic explorations. These "silent" early stages of the disease, combined with low awareness of periodontal health, often lead to many patients seeking "symptom-driven" care for advanced disease.[7]

An individual perceives > 2 symptoms (understood as "health upsets") per week,[8] so the need for clinical advice arises only when symptoms do not disappear by a natural process of after self-care approaches.[9,10] The self-regulatory model of emotional experiences applies to the process of disease assessment. According to this model, any experience acknowledged as a threat to one's own health is compared with memories of previous episodes, checked against other people's experiences, and compared to the patient's models of disease in order to decide on the importance and origin of the threat.[11] In the particular case of PDDs, where the symptoms are shared by a majority of adults and combine with the existing belief that tooth loss is inexorably linked to age,[12,13] diagnosis at advanced stages seems likely to occur. Early diagnosis of PDDs may offer clear advantages, not only because it is curable at the initial disease phases,[13] but also in terms of more affordable and simpler treatments with lower morbidity and better prognosis. In this sense, patients' periodontal awareness may play a key role in achieving this goal. Unfortunately, periodontal awareness of the general population seems to be low worldwide and important gaps of knowledge have been identified in every community-based report published so far.[14]

Some educational interventions, including mass media campaigns, have been undertaken to fill these gaps with positive results,[15,16] although limited in time. Despite these efforts, even in the most advanced countries, considerable segments of the population show high burdens of disease and experience difficulties in accessing health information and professional services.[17]

Periodontitis is easily diagnosed through a full-mouth periodontal assessment, and professional, inexpensive screening approaches were introduced > 25 years ago, although their routine adoption by all oral healthcare professionals has been a difficult objective to achieve.[17] In addition, 48.3% of the Spanish population is reported to visit dental centers at least on a yearly basis,[18] which may affect the burden of the disease.

Taking into account that 84.48% of the population had visited a physician in the last year,[19] dental problems may well represent a similar workload in general medical practice as some other conditions of the head and neck,[20] but some investigations have reported a lack of knowledge of primary care physicians about oral disorders.[21,22] This circumstance may also have an influence on treatment delay of periodontal disorders, as many patients with oral health concerns initially ask their physician rather than their dentist.[23–25]

Mainly because of the heavy workload experienced by healthcare systems in many countries, chronic disease services have shifted from secondary to primary care, and from physicians to nurses.[26] In fact, nurses have proved to be efficient in lifestyle counseling[27] without the barriers often described for physicians, such as insufficient time and lack of specific training and skills.[28] Given the reported relationships between periodontal diseases and chronic systemic disorders,[29] nurse practitioners may be in an excellent position to answer patients' PDD-related questions and to give adequate advice. Regrettably, their training on this topic is reported to be insufficient.[30]

The role of primary care physicians and nurses in preserving their patients' oral health is particularly relevant as the *Fédération Dentaire Internationale's* (FDI´s) new definition of oral health promotes incorporation of oral health into the mainstream of health and health care to ensure optimal oral and general health.[31] It is also in line with the increasing interest in the part of interprofessional collaborative practice in strengthening health systems and improving health outcomes, as many health systems throughout the world are fragmented and struggling to manage unmet health needs.[32]

Thus, the aim of this investigation was to assess the periodontal knowledge and awareness of a Spanish general population, together with that of their primary healthcare workers: physicians and nurses.

## 2 | MATERIALS AND METHODS

To achieve these goals, a cross-sectional study was designed using an anonymous questionnaire with two approaches: one for the general population, where the questionnaire was applied in the community to randomly selected laypersons by two interviewers (YUM and VQ) following the methodology described by Rogers et al,[33] and a different one for healthcare professionals who were systematically approached at their workplaces by a single interviewer (YUM).

The study protocol was approved by the Santiago-Lugo Committee for Ethics in Research (number 2014/600). Participants were approached in the community (laypersons) or at their workplaces (healthcare professionals) and invited to enter the study, whose results would be published anonymously. Once their oral consent was obtained, the questionnaire was applied by the interviewers. The results obtained from this research protocol are reported following the STROBE guidelines (STrengthening the Reporting of OBservational studies in Epidemiology).[34]

The study was undertaken in the city of Ourense (Northwest Spain), with an income per capita of 21,155 € and 105,893 inhabitants[35] who are served by 80 physicians and 85 nurses working at the primary care level[36] through a free, universal, national healthcare system. Data from the general population were obtained from March 1, 2016 to June 30, 2016, and data from healthcare workers were collected from October 1, 2016 to December 30, 2016. Only adults (aged > 18 years) entered the study. Exclusion criteria were mentally handicapped or poor command of any of the official languages of the community (Spanish or Galician). The questionnaire included a set of 24 items, and18 of them were used in this investigation: three questions about sociodemographic information (age, sex, and education level), and 15 about periodontal knowledge.

The survey instrument was made with the information obtained from a previous systematic search to identify all population-based reports published on this topic.[14] The most relevant items from those investigations were retrieved and a questionnaire constructed. This draft was assessed by a panel of experts who reviewed the contents in terms of relevance, clarity, simplicity, and need for each item.[37] The resulting instrument was piloted in a group of five healthcare workers and its items corrected, reformulated, or deleted accordingly. The final version of the tool was piloted both in a group of 10 undergraduate dental students and in a group of 97 participants in leisure-time activities at a community center (mostly > 65 years). As a result, further modifications were included in the instrument.

Sample size for the general population was determined by quota sampling considering an accessible population of 5% and an expected percentage of response of 28%,[33] resulting in a sample size of 1,034 individuals. This size permitted a power higher than 80% to detect 10% differences in the degree of periodontal knowledge. All primary care physicians and nurses working in the city were invited to enter the study.

To prevent interviewer-related biases, the interviewers participated in a 1-hour workshop which included discussion of the instrument items and related ethical aspects, role-playing, and interview to volunteers (undergraduate dental students) under the supervision of a psychologist (MALL).

Data were coded and entered into a database. Each questionnaire was identified by a single number, which permitted the assessment of the processes of data coding and mechanization in 40 randomly selected sets of data. Data were then transferred to a statistical package for analysis. For the sake of the analysis, missing data in knowledge-related items were considered as wrong answers. Descriptive analysis of categorical data displayed plain frequencies and percentages. Bivariate analysis was undertaken using the Chi square/Fisher's exact test with a chosen significance level of 5%.

## 3 | RESULTS

A total of 2,375 people were invited to enter the study (2,210 members of the public, 80 physicians, and 85 nurses). The percentage of responses was 60% for the general population (n = 1,326), 83.75% for physicians (n = 67), and 80% (n = 68) for nurses. No person was excluded from the study. The main reason argued by those declining entering the study was lack of time. All questionnaires were fully completed and were included in the study. The results are summarized in Table 1.

Most participants (54.39%; n = 799) were males in the age group 45 to 64 years (36.83%; n = 541). All nurses and physicians were familiar with periodontitis whereas less than half of the general population group had ever heard of periodontitis either by its technical or common names (Table 1).

When questioned about the causes of periodontal diseases, only 4% in the general population group mentioned bacteria. This view was shared by one-third of physicians and about two in ten nurses. When questioned about risk factors, most participants included bacteria in their answers (Table 1) and around two-thirds of healthcare workers and three quarters of laypersons recognized a part for genetics in periodontal diseases.

Regarding early symptoms of periodontal disorders, very few participants recognized gingival redness as a sign of periodontal problems. Gingival bleeding was mentioned by about half of primary care workers and by less than one quarter of the laypersons in the study. Conversely, tooth mobility is understood as a symptom of periodontal disease by one-third of the population and very few healthcare professionals. Laypersons also acknowledge better results regarding tooth loss as a consequence of periodontitis (Table 1).

Another interesting finding is that 44.3% of the population think gingival bleeding when brushing is normal, and this opinion is shared by some physicians and nurses. In fact, 45.1% in the public group, 28.4% of physicians, and 28.8% of nurses acknowledge gingival bleeding when toothbrushing ($P = 0.009$).

When asked about a hypothetical relationship between periodontal diseases and other health conditions, one-third of laypersons answered affirmatively, together with about half of healthcare workers. The relationship between diabetes and periodontitis is better known by the sample, although statistically significant differences remain between groups. The

**TABLE 1** Summary of the main results of the study (PDDs: periodontal diseases; *P*-values obtained by Chi square test)

| Variables | | Lay population n (%) | Physicians n (%) | Nurses n (%) | *P*-value |
|---|---|---|---|---|---|
| Age group | 18 to 34 | 314 (2.34) | 2 (2.98) | 7 (10.29) | **<0.001** |
| | 35 to 44 | 252 (19) | 7 (10.45) | 8 (11.76) | |
| | 45 to 64 | 430 (32.43) | 58 (86.57) | 53 (77.94) | |
| | >64 | 330 (24.89) | 0 (0) | 0 (0) | |
| Sex | Male | 766 (57.77) | 25 (37.31) | 8 (11.76) | **<0.001** |
| | Female | 560 (42.23) | 42 (62.68) | 68 (88.24) | |
| Level of education | University | 120 (9.8) | 67 (100) | 68 (100) | **<0.001** |
| | High School | 502 (41.3) | 0 (0) | 0 (0) | |
| | Compulsory | 596 (48.9) | 0 (0) | 0 (0) | |
| Ever heard of periodontitis | Yes | 624 (47.1) | 67 (100) | 66 (97) | **<0.001** |
| Etiology of periodontitis | Genetics | 51 (8.1) | 1 (1.4) | 2 (3) | 0.051 |
| | Age | 26 (4.1) | 0 (0) | 0 (0) | 0.068 |
| | Alcohol | 8 (1.2) | 0 (0) | 0 (0) | 1 |
| | Tobacco | 64 (10.2) | 0 (0) | 0 (0) | **<0.001** |
| | Bacteria | 25 (4) | 23 (34.3) | 11 (16.6) | **<0.001** |
| | Poor hygiene | 457 (73.2) | 57 (85) | 56 (84.8) | **0.017** |
| Periodontal risk factors | Genetics | 460 (76.9) | 42 (62.6) | 44 (66.6) | **0.012** |
| | Age | 423 (70.7) | 55 (82.1) | 49 (74.2) | **0.023** |
| | Tobacco | 527 (88.1) | 67 (100) | 65 (98.4) | **<0.001** |
| | Bacteria | 495 (82.7) | 67 (100) | 66 (100) | **<0.001** |
| | Poor hygiene | 592 (98.9) | 67 (100) | 66 (100) | 1 |
| | Diabetes | 397 (66.5) | 55 (82.1) | 52 (78.7) | **0.005** |
| PDDs signs and symptoms | Don't know | 154 (24.6) | 0 (0) | 3 (4.5) | **<0.001** |
| | Red gums | 90 (14.4) | 11 (16.4) | 14 (21.2) | 0.293 |
| | Bleeding gums | 139 (22.2) | 34 (50.7) | 33 (50) | **<0.001** |
| | Tooth mobility | 218 (34.9) | 5 (7.4) | 4 (6) | **<0.001** |
| | Gum recession | 73 (116) | 18 (26.8) | 17 (25.7) | **<0.001** |
| | Tooth loss | 85 (13.6) | 1 (1.4) | 3 (4.5) | **<0.001** |
| | Food impaction | 2 (0.3) | 0 (0) | 0 (0) | 1 |
| | Tooth sensitivity | 48 (7.7) | 5 (7.4) | 1 (1.3) | 0.168 |
| PDDs cannot be prevented | Agree | 47 (7.8) | 1 (1.4) | 2 (3) | 0.065 |
| You can't avoid calculus formation | Agree | 251 (41.9) | 2 (2.9) | 3 (4.5) | **<0.001** |
| There is no treatment for PDDs | Agree | 90 (15) | 0 (0) | 0 (0) | **0.001** |
| Some gum bleeding is normal when brushing teeth | Agree | 265 (44.3) | 6 (8.9) | 10 (15.1) | **<0.001** |
| Scaling damages teeth | Agree | 114 (19) | 0 (0) | 2 (3) | **<0.001** |
| PDDs linked to other health problems | Agree | 221 (37) | 35 (53) | 31 (47) | 0.082 |
| PDDs linked to tooth loss | Agree | 540 (90.3) | 66 (98.5) | 66 (100) | **0.002** |
| PDDs linked to jawbone damage | Agree | 409 (68.4) | 66 (98.5) | 66 (100) | **<0.001** |
| PDDs linked to heart infarction | Agree | 155 (25.9) | 35 (52.2) | 43 (65.1) | **<0.001** |
| PDDs linked to diabetes | Agree | 332 (55.5) | 51 (76.1) | 44 (66.6) | **0.001** |
| PDDs linked to preterm birth | Agree | 151 (25.2) | 21 (31.3) | 21 (31.8) | 0.310 |

link with cardiovascular disorders was recognized to a lesser extent by the sample, with the group of nurses scoring higher percentages of correct answers (almost two-thirds). The question about the relationship between periodontitis and pregnancy outcomes scored the lowest percentages of correct answers in this group of items. These results are shown in more detail in Table 1.

When the analysis was restricted to the highest educated members of the public in our sample, the percentage of those familiar with periodontitis reached 56.4%. In this group,

**TABLE 2** Risk factors for periodontal diseases

| Item | University graduates (n = 120) | Physicians (n = 67) | *P*-value[a] | Nurses (n = 68) | *P*-value[b] |
|---|---|---|---|---|---|
| Genetics | 75 (85.2) | 42 (62.6) | **0.002** | 44 (66.6) | **0.011** |
| Hygiene | 87 (98.9) | 67 (100) | 1.000 | 66 (100) | **1.000** |
| Tobacco | 79 (89.8) | 67 (100) | **0.005** | 65 (98.4) | **0.044** |
| Age | 64 (72.7) | 55 (82.1) | 0.185 | 49 (74.2) | 0.856 |
| Bacteria | 82 (93.2) | 67 (100) | **0.037** | 66 (100) | 0.038 |
| Alcohol | 54 (77.1) | 55 (82.1) | | 52 (78.7) | **0.763** |

Values in absolute cases and percentages in brackets. *P*-value calculated using Fisher's exact test.

[a]*P* value resulting from comparing university graduates with physicians.

[b]*P* value resulting from comparing university graduates with nurses.

11.1% acknowledged the bacterial etiology of periodontitis. This proportion is significantly lower than that recorded for healthcare professionals ($P = 0.002$). This difference in favor of physicians and nurses can also be seen when dealing with risk factors (Table 2), with the exception of the role of the individual's genetic background where the laypersons identified more frequently the right answer.

When questioned about a hypothetical relationship of PDDs with other health conditions, the sample was almost equally divided between those who find a relationship and those who do not, and no statistically significant differences were found among the three groups ($P = 0.956$). Physicians and nurses recognize oral-related problems more accurately than their general population counterparts, as well as cardiovascular problems (Table 3), but no differences were identified regarding diabetes and adverse pregnancy outcomes, as healthcare professionals answered in the same way as university graduates did.

An interesting finding is that related to the identification of PDDs (Table 4): holding a healthcare degree does not seem to warrant a better knowledge of early (red and bleeding gums) and advanced (tooth mobility and tooth loss) symptoms and signs of periodontal diseases. In fact, laypersons seem to recognize tooth mobility and tooth loss as symptoms of PDDs more frequently than do physicians and nurses.

Despite these findings, only 8.9% of physicians and 15.1% of nurses find some degree of gum bleeding when brushing their teeth, compared to 27.1% of other university graduates ($P = 0.018$).

## 4 | DISCUSSION

There are two main actors in the diagnosis of a disease: the patient and the healthcare professional. The time elapsed until an adequate treatment is started traditionally depends on the patient readiness to seek advice and on the knowledge of the clinician. This time may or may not have an influence on the outcome of the treatment, but it is reasonable to assume that an early treatment would improve patient's comfort and quality of life. For this to occur, the patient should be able to distinguish normalcy from disease and the clinician should be able to recognize early signs and symptoms to adequately address patient's needs.

Our results seem to show that these circumstances not only occur in our geographical area. In this sense, reports from different socioeconomic environments with different healthcare systems also describe low patient awareness and knowledge about periodontal diseases,[14–16] together with the need for physicians[20–23] and nurses[30] to increase their knowledge about oral health problems.

Although knowledge is one in a series of factors influencing health behavior, it can be considered a precondition of additional measures to improve health-related conducts[38] and, therefore, assessing knowledge about a disease is the basis to build a successful intervention for primary and/or secondary prevention.

Face-to-face surveys may be affected by an information bias from the interviewers, which was controlled by the already mentioned workshop undertaken before data collection. Another hypothetical bias is the possibility for participants to offer ideal responses, which was controlled by including negative questions where the correct answer required the participant to disagree with the interviewer.[39]

Representativity of our results is granted by the sampling method (where the participants were randomly approached in different streets and commercial areas of the city, at different hours and days, using a quota sampling method to ensure a proportional representation of age strata) and the size of the sample studied. It can be argued that those less knowledgeable about oral health may have declined the invitation to enter the study. In this conjectural situation, the size of the problem disclosed by this investigation would reinforce the need for an intervention.

Layperson's periodontal awareness in our study is low, as 52.9% did not know the mere existence of periodontitis. Although similar results have been reported worldwide,[14] our sample compares unfavorably with similar studies

**TABLE 3** Relationship of PDDs with other health conditions

| Health problem | University graduates (n = 120) | Physicians (n = 67) | *P*-value[a] | Nurses (n = 68) | *P*-value[b] |
|---|---|---|---|---|---|
| Tooth loss | 79 (89.8) | 66 (98.5) | **0.044** | 66 (100) | **0.011** |
| Damage to jaw bone | 74 (84.1) | 66 (98.5) | **0.002** | 65 (98.4) | **0.002** |
| Myocardial infarction | 31 (35.2) | 35 (52.2) | **0.049** | 43 (65.2) | **<0.001** |
| Diabetes | 58 (65.9) | 51 (76.1) | 0.214 | 44 (66.7) | **1.000** |
| Preterm birth | 25 (28.4) | 21 (31.3) | 0.725 | 21 (31.8) | 0.723 |

Values in absolute cases and percentages in brackets. *P*-value calculated using the Fisher's exact test.
[a]*P* value resulting from comparing university graduates with physicians.
[b]*P* value resulting from comparing university graduates with nurses.

**TABLE 4** Signs and symptoms of PDDs

| Sign/symptom | University graduates (n = 120) | Physicians (n = 67) | *P*-value[a] | Nurses (n = 68) | *P*-value[b] |
|---|---|---|---|---|---|
| No answer/don't know | 12 (13.3) | 0 (0) | **0.001** | 3 (4.5) | 0.098 |
| Reddish gums | 20 (22.2) | 11 (16.4) | 0.421 | 14 (21.2) | 1.000 |
| Gum bleeding | 44 (48.9) | 34 (50.7) | 0.872 | 33 (50.0) | 1.000 |
| Tooth mobility | 31 (34.4) | 5 (7.4) | **<0.001** | 4 (6.1) | **<0.001** |
| Gum recession | 11 (12.2) | 18 (26.8) | **0.023** | 17 (25.7) | 0.063 |
| Tooth loss | 27 (30.0) | 1 (1.5) | **<0.001** | 3 (4.5) | **<0.001** |
| Tooth sensitivity | 11 (12.2) | 5 (7.5) | 0.428 | 1 (1.5) | **0.014** |

Values in absolute cases and percentages in brackets. *P*-value calculated using the Fisher's exact test.
[a]*P* value resulting from comparing university graduates with physicians.
[b]*P* value resulting from comparing university graduates with nurses.

undertaken in Colombia (33.7%),[40] Nigeria (36.75%),[41] or Germany (15.6%).[38]

Periodontal awareness is a matter of growing concern, as the maintenance of periodontal health requires an informed public and patient because treatments would fail, or not even begin, if patients cannot tell the differences between periodontal health and disease.[42] In fact, it is considered the first step to periodontal diagnosis.[17] A number of interventions have been implemented to increase public awareness[15,16] with positive results that are not maintained over time,[16] thus requiring some kind of reminders.

Besides, those members of the public exhibiting lower levels of educational attainment usually score lower levels of health-related knowledge[43] and experience more difficulties in gaining information from public campaigns.[16] Thus, and in order to benchmark healthcare workers' periodontal knowledge, the answers of the latter group were compared to those given by the subgroup of population with similar cultural level. In this situation, when asked about the etiology of periodontal diseases, the highest educated stratum of the population mentioned bacteria (11.1%) in a proportion close to that of nurses (16.6%), being the observed statistically significant difference mostly due to the physicians' group (34.3%). It is somehow disheartening that only one in three general medical practitioners acknowledged the bacterial etiology of PDDs, which was established by the middle of the 20th century.

Better results were achieved when dealing with risk factors, although some aspects would benefit from educational interventions on this topic. Regarding the relationships of PDDs with other health conditions, all groups are divided by approximately 50%. A deeper look into the results shows that, when compared to their lay counterparts, the healthcare workers are more familiar with the oral consequences of PDDs than about their relationships with systemic conditions, with the exception of cardiovascular diseases perhaps linked to the recent statement of the American Heart Association[44] although about half of the physicians and one-third of the nurses are not aware of this link. When asked about diabetes and adverse pregnancy outcomes, reported knowledge by primary care nurses or physicians do not differ from that of university graduates. This is somehow shocking for the particular case of diabetes, as PDDs have been called "the sixth complications of diabetes".[45] On the other hand, the low percentages scored by all groups when questioned about adverse pregnancy outcomes could have been

reasonably advanced because of the inconsistency of research results on this issue.[46]

One of the most interesting findings of this investigation is the worrying lack of knowledge of both primary care physicians and nurses about the most frequent periodontitis-related signs and symptoms. This is an important barrier to PDDs diagnosis, given both the reported burden of oral conditions represent on general medical practice[20] and the fact that many patients would consult their physician about common oral problems rather than their dentist.[23–25] As a European directive[47] establishes common requirements for basic medical and nursing training, this problem may well be found elsewhere in the European Union. This is also important because many patients, when experiencing gingival bleeding, may be advised to use over the counter chemical plaque control agents which may mask a more serious underlying periodontal problem,[17] delaying treatment and favoring disease progression. The size of the problem is obviously related to the prevalence of regular dental check-ups, as those areas whose population is more reluctant to visit the dentist regularly rely more on the physicians' periodontal knowledge.

Early diagnosis and a timely and adequate treatment not only have a potential for improving quality of life, but also to reduce the lifelong social and financial burden linked to periodontal care.[17] It is also worth mentioning that missing or delayed diagnosis represents the leading cause of professional litigation in some countries.[48]

The call for global action on the burden of periodontal diseases endorsed by the European Federation of Periodontology, together with other learned national societies of periodontology,[17] highlights the need for enhancing public awareness of the early signs of the disease and improving patient and healthcare professionals information about periodontal treatment and the interdependence of periodontal health and systemic health, particularly among specific groups of patients, such as patients with diabetes. Our results seem to support this position paper and emphasize the unexpectedly low level of periodontal knowledge amongst primary care physicians and nurses.

Our study permitted the identification of new targets for educational interventions aimed at favoring early diagnosis and treatment of periodontal disorders. Addressing these interventions to primary healthcare workers may be a more efficient approach to this problem bearing in mind the limited impact of campaigns targeted to the general public and the important economic costs involved in using mass media to deliver health messages.[16]

## 5 | CONCLUSIONS

Our results show a low degree of periodontal knowledge both amongst the public and their primary care physicians and nurses and unveil unreliable targets (primary healthcare workers) for educational interventions to improve early diagnosis and treatment of periodontal disorders.

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ORIGINAL ARTICLE

WILEY ORAL DISEASES

# Periodontal awareness and what it actually means: A cross-sectional study

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**Abstract**

**Objectives**: To assess periodontal awareness among laypersons, to characterize the very aware of periodontitis and to disclose whether high awareness implies sufficient periodontal knowledge.

**Subjects and methods**: Cross-sectional study on laypersons randomly selected by quota sampling from March 2015 to June 2016. The questionnaire of periodontal awareness included aspects of aetiology, risk factors, signs and symptoms, related risks, prevention, treatment and related attitudes. It was applied by 12 interviewers in the community in each four province capitals, in a sort of pathfinder survey method.

**Results**: A 43.3% response rate was obtained, and 3,553 people entered the study. "Very aware": 19.4%. "Aware": 42.7%. "Not aware": 37.9%. Age, oral self-care and educational achievements characterized those "very aware." Any additional degree beyond compulsory education halves the chances for being "not periodontally aware." Very aware people likely to have periodontitis were elder, less educated, with a smoking history and less knowledge of the disease. Gaps of knowledge among the "very aware" were identified in all aspects except for "prevention" and "treatment.".

**Conclusions**: Very periodontally aware people were in their late 40–60 s, followed sound oral care routines and held a degree but elicited insufficient knowledge about aetiology, signs-symptoms, related risks or periodontal risk factors.

KEYWORDS
awareness, cross-sectional, dental health surveys, general population, periodontitis

## 1 | INTRODUCTION

Periodontal diseases can be broadly defined as inflammatory disorders affecting the tooth supporting apparatus including a mild, reversible form (gingivitis), and periodontitis, an inflammation progressing deeper into the tissues causing progressive loss of attachment and bone damage (Pihlstrom, Michalowicz, & Johnson, 2005).

Although the prevalence and severity of periodontitis have decreased over the last 50–60 years (Page & Eke, 2007), these improvements tend to be restricted to gingivitis and mild/moderate forms of periodontitis (Demmer & Papapanou, 2010). Overall prevalence of periodontitis remains high (Bourgeois, Bouchard, & Mattout, 2007), and an increment among elder groups may be expected in the near future due to an increased number of retained

teeth (Demmer & Papapanou, 2010). In addition, the incidence of severe periodontitis gradually increases with age, with peaks at the third and fourth decades of life (Kassebaum et al., 2014). This puts the need for periodontitis prevention into a new socio-economic perspective (Deinzer, Micheelis, Granrath, & Hoffmann, 2009).

Early diagnosis of periodontal diseases would facilitate earlier treatments, which can be presumed simpler and with a better prognosis. A mandatory precondition for treatment is the patient seeking consultation about a sign or symptom recognized as abnormal. This recognition takes time, and the length of this appraisal period is reported to depend on the person's background and health-related knowledge (Noonan, 2014).

In the particular case of periodontitis, the appraisal period is likely to be long because early periodontal signs are quite common among adult populations (Dye, 2012) and the acknowledgement of a sign/symptom as a threat for the own health is based upon previous memories and checked against other people's experiences (Leventhal, Brissette, & Leventha, 2003). In addition, patients usually remain asymptomatic until tooth mobility becomes apparent (Pihlstrom et al., 2005) and even at this point specialized advice is not always requested because of the belief that tooth loss and mobility are inexorably linked to ageing (De Marchi, Leal, Padilha, & Brondani, 2012). These circumstances often result in many patients seeking care when massive attachment breakdown has already occurred.

Alarm signs of a periodontal disorder may include gingival redness and bleeding during toothbrushing, which can progress to gum recession, tooth mobility or pathological tooth migration (Jin, 2009). If patients were aware of the meaning of these indications, the chances for early treatment would increase with the inherent contribution to lowering the burden of the disease, which is reported to be high in considerable segments of the population (Tonetti, Jepsen, Jin, & Otomo-Corgel, 2017).

Unfortunately, periodontal awareness is low with important gaps of knowledge worldwide (Varela-Centelles et al., 2016). There are no previous studies on periodontal knowledge in Spain. In fact, and to the best or our knowledge, this is the first study of its kind undertaken in southern Europe.

A recent national epidemiological study has revealed that less than 20% of the Spanish adult population has a healthy periodontium (19.4% in the 35–44 age group; 11.1% in the population subgroup of 65–74 years old). Regarding loss of attachment, 66.1% of the people in the 35–44 age group and 29.1% in the 65–74 had lost three or less mm (Bravo-Pérez et al., 2016).

The role of awareness in the control of periodontitis is well established together with the need for increasing it at the community level. More than 30 years ago, Ainamo (1980) already stated that "no major improvements [in periodontal health] can be expected unless attitudes of society undergo essential changes."

Periodontal awareness has been found to influence daily oral hygiene practices and routine periodontal care by dental professionals (Jin et al., 2011). Poor oral self-care and non-compliance go along with periodontitis progression and tooth loss (König, Plagmann, Langenfeld, & Kocher, 2001). Moreover, ensuring an adequate level of periodontal awareness in the community would improve the reliability of the widely used self-reported oral health questionnaires in epidemiological investigations (Meisel, Holtfreter, Völzke, & Kocher, 2018), as individuals reporting having periodontal disease are usually right (Airila-Mansson, Söder, Jin, Söder, & Klinge, 2004).

Awareness of a condition is often assessed by investigating whether people have heard of it, either by prompting an answer or without doing it (Gerhard, Ritenour, Goodman, Vashi, & Hsiao, 2014; Maslovskaya, Brown, Smith, & Padmadas, 2014; Mun et al., 2015; Yoo, Choi, Jung, & Jun, 2012). In the realm of periodontics, existing studies on this topic are mainly based on convenience samples (Varela-Centelles et al., 2016), and only two papers report on community-based investigations undertaken in this century (Deinzer et al., 2009; Gholami, Pakdaman, Jafari, & Virtanen, 2014). This approach is undoubtedly interesting and useful when evaluating the need for educational interventions in the community and it is usually supplemented with an assessment of the current knowledge of the disorder among the public, if meaningful results are to be obtained.

In this sense, reports focused on discriminating the level of periodontal knowledge (Airila-Mansson et al., 2004; Lin, Wong, Wang, & Lo, 2001; Martensson, Söderfeldt, Halling, & Renvert, 2004) do not necessarily reflect the level of alertness towards the disorder in the community, which seems a key issue for reaching early diagnoses and treatments.

Our study departs from the hypothesis that periodontal awareness in the population is poor and also that even those very aware of periodontitis have significant gaps in their periodontal knowledge.

Therefore, the aims of this study were to assess the level of periodontal awareness among laypersons, to characterize the very aware population subgroup and to disclose whether being very aware is linked to sufficient periodontal knowledge.

## 2 | METHODS AND MATERIALS

A cross-sectional study was designed using a previously described questionnaire (Varela-Centelles et al., 2018) applied in the community to randomly selected laypersons. This instrument included a set of 24 items: three questions about socio-demographic information (age, gender and education level), two questions about awareness (periodontitis/pyorrhoea), two about periodontal status (gum bleeding and tooth mobility), two about habits and routines and 15 about periodontal knowledge.

The study protocol was approved by the Santiago-Lugo Committee for Ethics in Research (number 2014/600). This investigation complied with the Spanish regulations and the Helsinki Declaration on ethical principles for medical research involving human subjects (World Medical Association, 2013). The results obtained from this research protocol are reported following the STROBE guidelines (Strengthening The Reporting of OBservational studies in Epidemiology) (Vandenbroucke et al., 2009).

The study was undertaken in Galicia (North-Western Spain), an autonomous region with 2,708,339 inhabitants unevenly distributed

in 29,574.4 km$^2$, whose gross domestic product per capita is 21,358 € and their life expectancy at birth of 82, 78 years (IGE, 2018).

Data were obtained from 1 March 2015 to 30 June 2016 in the four Galician provinces. Only people over 18 entered the study. Exclusion criteria were being mentally handicapped and poor command of any of the official languages of the community (Galician or Spanish).

Sample size was determined by quota sampling considering an accessible population of 5% and an expected percentage of response of 28% (Rogers, Hunter, & Lowe, 2011). The resulting sample size of 10,804 persons permitted a power of 0.8% for estimating the proportion of very periodontally aware people, presuming a value of 25%.

The survey instrument was applied to randomly selected volunteers in the community by a group of 12 interviewers—postgraduate ($n$ = 7) and undergraduate dental students ($n$ = 2), one undergraduate medical student and two nurses—in four different areas of each four province capitals in the region and their metropolitan areas. These zones included administrative areas and affluent and average-income commercial streets and shopping centres, in a sort of pathfinder survey method (WHO, 2013).

For the sake of this study, a gap in periodontal knowledge about a topic was defined as the absence of answer, incorrect answer or erroneous identification given by 33% of the sample investigated (Varela-Centelles et al., 2016).

Subjects were asked to enumerate the oral disorders/diseases they had heard of, and the first four registered in the questionnaire. If periodontitis was not mentioned, the interviewer would specifically ask whether the participants had heard of periodontitis or pyorrhoea. Participants in the first group were classified as "very aware", those in the second group as "aware," and those who had not heard of periodontitis/pyorrhoea as "not aware."

In an attempt to control biases, the interviewers participated in a 1-hr-long workshop which included discussion of the items in the instrument and the related ethical aspects, together with a role-playing session and a series of interviews to volunteer subjects (undergraduate dental students) under the supervision of a psychologist.

Data were coded and entered into a database. Each questionnaire was identified by a single number to permit an evaluation of the process of data coding and mechanization in a sample of randomly selected sets of data. Data were then transferred to statistical packages (R v3.3.2, MASS, and nnet) (R Core Team, 2014; Venables & Ripley, 2002) for analyses.

A descriptive analysis of categorical data was undertaken, and results are presented as plain frequencies and percentages. Bivariate analysis was undertaken using the chi-square/Fisher's exact test. A multinomial regression analysis was performed to identify the main socio-demographic features of the participants according to their awareness level. This approach permitted comparing more than two categories, taking one of them as a reference (very aware) and computing their ratios. The results are expressed in terms of odds ratio with their 95% confidence intervals.

The level of significance chosen for all test was 5%.

## 3 | RESULTS

A total of 8,206 subjects were invited to enter the study, and 3,553 of them accepted the invitation (43.3%).

All completed questionnaires were useful for the aims of the investigation.

The main socio-demographic features of the sample are summarized in Table 1.

**TABLE 1** Main features of the sample studied and distribution of the awareness level

| Variable | Total ($n$ = 3,553) | Not aware ($n$ = 1,347) | Aware ($n$ = 1,517) | Very aware ($n$ = 689) | $p$-value |
|---|---|---|---|---|---|
| Gender | | | | | |
| Male | 1,744 (49.1) | 756 (56.1) | 671 (44.2) | 316 (45.9) | <0.001 |
| Female | 1,809 (50.9) | 591 (43.9) | 856 (55.8) | 373 (54.1) | |
| Age group | | | | | |
| 18–34 | 1,062 (29.9) | 526 (39.0) | 379 (25.0) | 157 (22.8) | <0.001 |
| 35–44 | 695 (19.6) | 214 (15.8) | 326 (21.4) | 155 (22.5) | |
| 45–64 | 1,007 (28.3) | 264 (19.6) | 485 (31.9) | 258 (37.3) | |
| >64 | 789 (22.2) | 343 (25.6) | 327 (21.5) | 119 (17.3) | |
| Educational achievements | | | | | |
| Compulsory education | 1,054 (32.6) | 442 (42.5) | 468 (31.0) | 144 (20.9) | <0.001 |
| High School | 988 (30.6) | 402 (38.7) | 426 (28.2) | 160 (23.2) | |
| Vocational training | 441 (13.6) | 81 (7.8) | 244 (16.1) | 116 (16.9) | |
| University degree | 750 (23.2) | 112 (11.0) | 371 (24.7) | 267 (39.0) | |

*Note.* $n$ (%); $p$-value obtained from chi-square test.

Most participants were classified as "periodontally aware" (1,517; 42.7%), and only 19.4% ($n$ = 689) could be included in the "very aware" group according to the criteria set for the study. More than one third of the interviewees had not heard about periodontitis/pyorrhoea and were categorized as "not aware" (1,347; 37.9%). The "very aware" group included a higher percentage of women (373; 54.1%). Periodontal awareness seemed to increase with age and diminished among people elder than 64. The very aware group included a higher proportion of university graduates (Table 1).

Our results permitted the identification of gaps of periodontal knowledge among the very aware group of laypersons in all aspects explored except for "prevention" and "treatment" (Table 2). The presence of gaps of knowledge about aetiology, in the recognition of signs or symptoms, or about the relationship of periodontitis with other disorders was particularly interesting and showed that even this population subgroup was susceptible to a potential delay in diagnosis of periodontitis, which may be aggravated by the reported lack of adequate oral self-care routines and dental check-ups.

Age, higher education and adequate oral self-care practices were related to periodontal awareness. In fact, periodontally aware people were likely to be in their late forties-early sixties, follow sound oral care routines and hold a professional or university degree. Gender or tobacco habit did not seem to have a clear part in this issue.

Our results showed periodontal awareness consistently increased with educational achievements: any additional degree beyond compulsory education halved the chances for being in the "not aware" group. Besides, each step in the educational ladder increased the probabilities for being in the very aware group by about 20% (Figure 1).

In an attempt to disclose whether the reported periodontal knowledge was conditioned by actually experiencing the disease, a new variable was constructed using two specific questions in the instrument: "Do your gums bleed?" and "Do you have any mobile tooth?" Those interviewees answering "yes" to both questions were considered to have high chances of experiencing periodontitis. Only 38 subjects (8.2%) in the very aware group met these criteria. These individuals resulted to be elder ($p$ = 0.034), with lower educational achievements ($p$ < 0.001), and with a history of tobacco habit ($p$ = 0.038) more frequent than their counterparts in the very aware group. In terms of knowledge, very aware periodontitis-affected participants linked less frequently (23.6%) periodontitis with cardiovascular diseases than their fellow members with healthy periodontium (42.9%; $p$ = 0.042). The same phenomenon occurred regarding jawbone affectation (71% vs. 85.1%; $p$ = 0.044). Concerning signs and symptoms, periodontally affected very aware people were not so good both at recognizing the abnormality of gum bleeding with gentle toothbrushing when compared to other members of the very aware subgroup of participants (36.8% vs. 70%; $p$ < 0.001), and at acknowledging that periodontitis can be treated (92.2% vs. 73%; $p$ < 0.001). Periodontitis-affected people in the very aware group also thought more frequently that periodontitis cannot be prevented when compared to very aware persons who did not report gingival bleeding and tooth mobility (65.8% vs. 90%; $p$ < 0.001). No significant differences could be identified in terms of annual dental check-ups between both groups (63% vs. 63.1%; $p$ = 0.991).

**TABLE 2** Gaps of periodontal knowledge among very aware laypersons ($n$ = 689)

| Dimension | Item | N (%) | Gap[a] |
|---|---|---|---|
| Aetiology | Acknowledge bacterial aetiology | 116 (16.8) | Yes |
| Risk factors | Age | 411 (61.5) | Yes |
| | Diabetes | 369 (55.4) | Yes |
| | Genetics | 499 (74.7) | No |
| | Hygiene | 649 (97.1) | No |
| | Tobacco | 629 (94.1) | No |
| | Bacteria | 641 (95.9) | No |
| Signs & symptoms | Able to mention two symptoms of periodontitis/pyorrhoea | 323 (46.8) | Yes |
| | Gums should not bleed at gentle toothbrushing | 452 (67.6) | No |
| Related risks | Periodontitis can be related to other disorders | 396 (59.3) | Yes |
| | Periodontitis can be linked to cardiovascular disorders | 281 (42.0) | Yes |
| | Periodontitis can be related to diabetes | 295 (44.1) | Yes |
| | Periodontitis can be related to adverse pregnancy outcomes | 104 (15.6) | Yes |
| | Periodontitis can be linked to jawbone damage | 563 (84.2) | No |
| | Periodontitis can be linked to tooth loss | 642 (96.1) | No |
| Prevention | Periodontitis can be prevented | 582 (87.3) | No |
| | You cannot avoid calculus formation in the mouth | 519 (77.7) | No |
| | Scaling damages teeth | 523 (78.2) | No |
| Treatment | Periodontitis can be treated | 605 (90.9) | No |
| Attitudes | Report good routine of oral self-care practices | 117 (16.9) | Yes |
| | Regular dental check-ups (on a yearly basis) | 425 (61.7) | Yes |

[a]Gap was defined as the absence of answer, incorrect answer or erroneous identification given by at least 33% of the sample.

## 4 | DISCUSSION

Our results show a disheartening picture of a community where—despite having a ratio of dentists per capita above the European average (CGCOE, 2016)—more than one third of the participants had never heard about periodontitis/pyorrhoea, and just one in five interviewees could be considered to be very aware of the existence of periodontitis according to the criteria set in this study (active

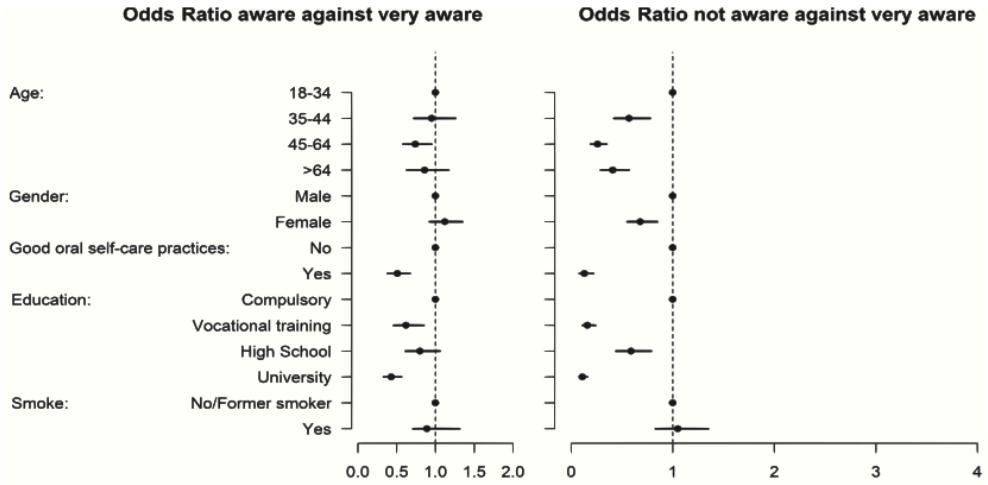


**FIGURE 1** Graphic representation of OR for the "aware" and "not aware" groups (Reference: "very aware" group)

knowledge). A similar proportion of people not aware of the mere existence of periodontitis has been reported in Colombia (Duque, Cuartas, Muñoz, Salazar, & Sánchez, 2011) or Nigeria (Savage, 1994), but our sample is far from the 15.6% described in Germany (Deinzer et al., 2009).

Periodontal awareness in our sample somehow accompanies periodontitis prevalence, which is reported to gradually increase with age (Kassebaum et al., 2014). This positive phenomenon in terms of possibility for early diagnosis and treatment is truncated at the group elder than 64, where the chances for advanced disease and related tooth loss increase. This finding—lower awareness and knowledge in the elder group of participants—is frequent in the literature (El-Qaderi & Ta'ani, 2004; Lin et al., 2001), as it is the relationship between periodontal knowledge and educational achievements (Gholami, Pakdaman, Montazeri, Jafari, & Virtanen, 2014; Macek et al., 2011; Varela-Centelles et al., 2018).

Although the very aware group showed higher levels of knowledge than those asked specifically about periodontitis (passive knowledge), these levels are clearly insufficient in dimensions such as aetiology, signs and symptoms, risk factors, or related risks. Conversely, they achieved results beyond the threshold set for the study in aspects related to prevention and treatment of periodontitis. Even so, more than 10% of persons very aware of periodontitis believe periodontitis cannot be prevented and nearly one quarter of the sample think it is not possible to avoid calculus formation and also that scaling damages teeth.

Although our sample achieves better results than population-based studies in Germany (57.3% thinks emergence of dental calculus cannot be avoided) (Deinzer et al., 2009), Iran (11.1% affirms periodontitis is not preventable) (Gholami, Pakdaman, Montazeri et al., 2014) or Hong Kong (27.8% complain about scaling and 12.1% think scaling makes teeth thinner) (Young, 2008), it has to be kept in mind that our data reflect the views of the subgroup of very aware population in our sample, rather than percentages for the overall population as the aforesaid reports state.

In this vein, the gap of knowledge identified regarding the aetiology of periodontitis (16.8%) is particularly important, as correct information on this topic can condition attitudes towards treatment and prevention. Existing reports show a wide range of percentages of correct answers to aetiology-related items [e.g. Iran (13.8%) (Gholami, Pakdaman, Montazeri et al., 2014), Jordan (26.8%) (Taani, 2002) or Germany (77.8%) (Deinzer et al., 2009)]. In these studies, dental plaque is considered the right answer, but the concept laypersons have of dental plaque is not always accurate (Gholami, Pakdaman, Montazeri et al., 2014; Taani, 2002) and may not necessarily include bacteria among its components—the idea behind de question—which is ensured in our study.

Gingival bleeding is reported to be the most reliable and easily self-detected indicator for gingivitis (Azodo & Ojehanon, 2012). Although 67.7% of the sample recognized this sign as abnormal, less than half of the very periodontally aware people could mention at least two signs or symptoms of periodontal alterations. These findings seem particularly worrying, as these alert signs should trigger consultation to a healthcare worker.

Moreover, this proportion is likely to increase among the population subgroups with poorer periodontal awareness with the subsequent decrease in the chances for an early diagnosis and treatment. In addition, a previous study in the region warns about the unexpectedly low level of periodontal knowledge of primary care physicians and nurses (Varela-Centelles et al., 2018). These findings highlight the need for comprehensive educational interventions, which have demonstrated useful for promoting periodontal health (Duque et al.,

2011; Gholami, Pakdaman, Montazeri et al., 2014; Martensson et al., 2004) and increasing knowledge of the disorder.

Another topic to include in this hypothetical intervention should be oral self-care practices, as just 17% in this particularly aware group of people report to follow an adequate daily oral hygiene routine. It was proved more than 50 years ago that neglecting oral hygiene causes calculus formation and gingivitis (Löe, Theilade, & Jensen, 1965) and also that calculus and chronic gingivitis are predictors for loss of attachment and future tooth loss (Schätzle et al., 2009). Adding the undesired effects of poor oral hygiene practices to the increment of life expectancy and the observed decrease in the prevalence of tooth loss in recent years, an increase in the burden of severe periodontitis is to be expected in the future (Kassebaum et al., 2014). Health decision-makers should consider these results to inform policy and practice, as failure to do so may result in serious consequences for users of health care and to inefficient use of resources for healthcare provision (Jürgensen, Petersen, Ogawa, & Matsumoto, 2012).

Another gap of knowledge that would justify educational interventions according to the criterion set in our study is the relationship between periodontitis and systemic disorders. Although this is a common finding in the literature (Deinzer et al., 2009; Gholami, Pakdaman, Jafari et al., 2014), the high percentage of people ignoring the relationship between diabetes and periodontitis (55.9%) in this subgroup of patients is particularly noteworthy, as periodontitis was defined "the sixth complication of diabetes" by the end of last century (Löe, 1993).

Another interesting finding of our study is that being very aware of the existence of periodontitis does not seem to grant regular dental check-ups, despite we set that threshold at 1 visit per year. Unfortunately, as shown by our results, awareness and knowledge do not necessarily imply a healthier behaviour, as factors such as self-efficacy expectations, effort/benefit analysis or perceived susceptibility also have an influence (Prochaska, 2013). Educational interventions have to take these factors into account (Deinzer et al., 2009).

In order to disclose a hypothetical influence of actually having periodontal disease on knowledge and periodontal awareness, we separated a set of participants likely to be experiencing periodontitis from the rest of the very aware group of interviewees. These participants are characterized by the same variables predicting lower periodontal awareness (age, educational achievements and history of tobacco habit) and scored similar or lower percentages in knowledge-related items, so this potential influence can be ruled out. In this sense, it may be worth to investigate whether these patients are being treated and, if so, what information about their disease do they receive from their dentists.

A potential weakness of our study is the limited number of subjects enrolled. Thus, the precision of the study was recalculated for the sample size finally obtained (3,553), considering it an infinite population. It resulted a probability for a precision error of 1.4% in the estimation of a proportion by an asymptotic 95% bilateral confidence interval, assuming an expected proportion of 28%. In any case, to date, this is the study on the subject with the largest sample size and the first of its kind undertaken in southern Europe. In addition, recruiting people in the most important commercial and administrative areas of the four provinces in the region over a large period of time, together with the participation of specifically trained interviewers with adequate knowledge of the topic (mostly postgraduate and undergraduate dental students), may have contributed to overcome this shortcoming.

Survey studies using face-to-face interviews are at risk for an information bias inherent to the existence of interviewers and the possibility for the participant to receive different, additional explanations from them. To prevent this circumstance, all interviewers participated on a workshop to discuss all aspects of the investigations which included supervised practice (Varela-Centelles et al., 2018). The questionnaire included indications for the interviewer to connect the different items in the instrument ensuring a homogeneous interview. Some items in the instrument were presented in negative form, whose correct response required the participant to disagree with the interviewer in order to control for the reported trend of interviewees to give ideal responses when asked direct questions (Lin et al., 2001).

There is a possibility for a selection bias in our study, as those individuals with negative attitudes towards oral health may have declined the invitation to enter the study more frequently than other people. This phenomenon, if occurred, would only contribute to highlight the important deficit of periodontal knowledge disclosed by our results and reinforce the need for educational interventions on this topic.

In these circumstances, our results show a dependable first picture of the problem of periodontal awareness in Spain. Unawareness may be a reason for periodontal health inequalities (Jin et al., 2011) which can condition general health and quality of life (Petersen, 2009). There is now sufficient evidence about the link of periodontal disease to systemic conditions and the number of modifiable risk factors periodontitis has in common with certain non-communicable chronic diseases (Jürgensen et al., 2012). So, the opportunity for including periodontal health in all levels of public health intervention exists (Ng & de Colombani, 2015) and periodontal disease meets the four main criteria for prioritization of public health conditions: it represents a large aggregate burden of disease; displays large disparities across and within populations; disproportionally affects certain populations or groups between populations; and it is emerging or epidemic prone (Jürgensen et al., 2012).

Awareness is linked to knowledge about the disorder, so interventions to increase periodontal awareness have to provide information about different aspects of periodontitis, focusing on the gaps identified in the population. Although knowledge is just one factor affecting health behaviour modifications, it is a fundamental one and the first step in a wider approach for improving periodontal health at a community level (Deinzer et al., 2009).

It is concluded that "very aware" interviewees were in their late 40–60 s, followed sound oral care routines and held a degree. They elicited insufficient knowledge about aetiology, signs-symptoms,

related risks or periodontal risk factors. Thus, periodontal awareness should be increased and public health interventions are needed on this issue within a broader approach to improve periodontal health of the population.

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## CONFLICT OF INTEREST

The authors report no conflict of interest related to this study.

## AUTHORS' CONTRIBUTION

All authors contributed equally to this investigation. Drs Varela-Centelles, Estany-Gestal, Blanco-Hortas and Seoane-Romero conceived the study and designed the investigation with the collaboration of Drs Diz-Iglesias and Bugarín-González. Drs Diz-Iglesias, Blanco-Carrión, Bugarín-González and Seoane-Romero coordinated Data acquisition. Drs Blanco-Carrión, Blanco-Hortas, Estany-Gestal and Varela-Centelles focused on data analysis and interpretation. Drs Blanco-Carrión, Blanco-Hortas, Estany-Gestal and Varela-Centelles drafted the manuscript. All authors critically reviewed all drafts of the manuscript and approved its final version.

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ORIGINAL ARTICLE

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# Regular dental attendance and periodontal health knowledge: A cross-sectional survey

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## Abstract

**Objectives:** To explore dental clinics' performance on periodontal education by comparing knowledge about periodontal health of regular and inconsistent dental attenders.

**Subjects and Methods:** A population-based study with a cross-sectional design was performed in Galicia (Northwestern Spain). Participants were randomly selected from 16 different areas and a questionnaire applied face-to-face. The survey included items on socio-demographic features, habits and routines, periodontal status and periodontal health knowledge. Participants were grouped according to the median of overall knowledge, and a logistic regression analysis was performed to explore the relationship between good periodontal knowledge and frequency of dental visits.

**Results:** A total of 8,206 individuals were invited to enter the study, and 3,553 of them accepted the invitation (43.3%). Most participants (59.3%; *n* = 1,945) fit within the regular dental attenders' group. Younger women holding a university degree and visiting their dentist regularly elicited higher knowledge about periodontal health. Regular use of dental services increased the chances of being in the higher knowledge group (OR: 1.67; 95% CI: 1.40–2.00).

**Conclusions:** Reported regular dental attendance is related to periodontal health knowledge. Specific interventions for promoting tailored patient education on periodontal topics during routine dental visits may have a positive effect on laypersons' knowledge about periodontal health.

KEYWORDS
dental clinics, dental health education, dentists, patient education, periodontitis

## 1 | INTRODUCTION

Periodontal diseases (PDs) are defined as the pathologic processes affecting the periodontium, most often gingivitis and periodontitis (American Academy of Periodontology, 2018), which affect about 90% of the world adult population (Albandar & Rams, 2002). While gingivitis is a reversible inflammation of the gingivae, the inflammatory process in periodontitis results in periodontal pocketing, clinical attachment loss and alveolar bone damage (American Academy of Periodontology, 2018) which may end in tooth loss. These inflammatory reactions are a response to the biofilm accumulated on tooth surfaces in the absence of adequate oral

hygiene (Botero, Rodríguez, & Agudelo-Suárez, 2016). As the ultimate cause of periodontitis is the accretion of bacteria around teeth, treatments are traditionally focused on reaching a bacterial load compatible with periodontal health (Varela-López, Giampieri, Bullón, Battino, & Quiles, 2016).

Periodontitis has been related to a growing list of systemic disorders (Holmstrup et al., 2017), particularly diabetes (Löe, 1993), cardiovascular diseases (Lockhart et al., 2012) and adverse pregnancy outcomes (Pretorius, Jagatt, & Lamont, 2007). Considering the usually chronic nature of periodontitis and the tissue loss linked to its progression, early diagnosis may well result in easier, more effective treatments reducing the financial and social burden of the disease for the individual and the community.

For a diagnosis to be made, the patient has to demand consultation with a clinician but only symptoms perceived as atypical would be a matter of concern. Thus, vague, unspecific indicators common to a large proportion of individuals—less than 20% Spaniards elder than 35 have a healthy periodontium (Bravo Pérez et al., 2016)—and which are typical of early periodontal disorders (Dye, 2012), may not worry the patient until disease progression is evidenced through more serious manifestations. In this situation, the desirable early periodontal treatment (Slots, 2013) depends on the recognition of the initial symptoms of the disease, a circumstance that does not seem to occur in large groups of the world population (Varela-Centelles et al., 2016).

A number of public health interventions on the general public have been undertaken in different countries to tackle this problem with positive results (Gholami, Pakdaman, Montazeri, & Virtanen, 2017; Martensson, Söderfeldt, Halling, & Renvert, 2004) although limited in time. Major issues with these campaigns are the important economic effort required and the limited information gained by the less educated strata of the population (Gholami et al., 2017), who actually need it most (Holtzman, Atchison, Macek, & Markovic, 2017; Volandes & Paasche-Orlow, 2007).

Primary care clinics seem to be the natural place for health education (International Conference of Primary Health Care, 1978), and patient education—understood as the teaching or training of patients concerning their own health needs (US National Library of Medicine, 2019)—should be an integral part of communication between health providers and patients (Hoving, Visser, Mullen, & Van den Borne, 2010). There are a number of successful experiences of patient education by physicians and their ancillary staff at the primary care level (Messina, Campbell, Morris, Eyles, & Sanders, 2017; Rindner et al., 2017; Sriphanlop, Hennelly, Sperling, Villagra, & Jandorf, 2016), although there is some concern about the knowledge physicians have about oral disorders in general (Rabiei, Mohebbi, Patja, & Virtanen, 2012) and PDs in particular (Varela-Centelles et al., 2018).

In the case of dental clinics, patient education has been focused since 1970s in instructions for dental care, anxiety and decision-making in complex cases, although these efforts have not always been well recognised (Hoving et al., 2010). In fact, patient education is necessary for adequate oral care (Hughes, Heo, & Levin, 2018), and dental clinics appear to be the best settings for patient education, as information can be tailored to match patient's characteristics and needs while taking advantage of the opportunity to interact with qualified providers. A shortcoming of this approach would be the variable frequency of dental visits in the population (Aldossary, Harrison, & Bernabé, 2015). In Spain, 40.5% of the population visited a dentist last year, compared with the 44.5% in Galicia, the area where this study was undertaken (Galician Institute for Statistics, 2018).

Dental care in Spain is provided through a public, free and universal national health system with a nationwide network of healthcare centres where dental services are limited to oral surgery for the whole population, and preventive and restorative treatments in permanent dentition for paediatric patients. Other dental treatments are provided by private clinics, with or without individual insurance schemes. This results in 76.6% of the people in Spain and 82.1% of the Galician population having attended a private clinic for their last dental visit (Galician Institute for Statistics, 2018).

Bearing in mind the reported low level of knowledge of periodontal health elicited by laypersons (Varela-Centelles et al., 2016), together with the gaps observed for physicians and nurses (Varela-Centelles et al., 2018), and combined with the high prevalence of periodontal disorders (Albandar & Rams, 2002), dental clinics should be expected to be the cornerstone of patient periodontal education. A pilot study on general dental practitioners found they perceived useful the participation of the entire dental team in educating patients on periodontal risk factors (Raidi, Thornley, & Thornley, 2015). In fact, much of the burden of patient education lies with dental hygienists because of their positive influence on patients' knowledge, motivation and self-care (Ultembroek, Schaub, Tromp, & Kant, 1989), and also because dentists find important barriers for educating their patients, such as lack of time, remuneration or patient compliance (Thevissen, Bruyn, & Koole, 2017). Actually, hygienists find themselves highly skilled and knowledgeable about patient education, although it is not always implemented to those high standards (Rantanen et al., 2010), frequently lacking adequate assessment of patients' educational needs and showing poor patient empowerment. Despite these shortcomings, behavioural modification by dental professionals can be achieved (Wilson, Hele, & Temple, 1993). A recent systematic review found that educational interventions in health services offer significant improvements in periodontal outcomes, concluding that educational interventions undertaken by health professionals in the context of their practice have the potential to promote oral health in the population (Menegaz, Silva, & Cascaes, 2018).

Considering the aforementioned circumstances, dental offices may be at an advantageous position to undertake opportunistic periodontal health education (Glavind, 1986; Menegaz et al., 2018) and we hypothesise that regular dental attendance has an influence on patients' periodontal health knowledge. In this sense, the aim of this study was to indirectly explore the performance of dental clinics on periodontal education by comparing the levels of periodontal knowledge among regular users of dental services with those of inconsistent attenders.

## 2 | MATERIALS AND METHODS

This was a cross-sectional, population-based survey of randomly selected respondents from Galicia (Northwestern Spain) conducted from 1 March 2015 through 30 June 2016. The questionnaire was applied face-to-face by 12 interviewers (7 postgraduate and 2 undergraduate dental students, one undergraduate medical student, and two nurses).

### 2.1 | Instrument development

This instrument was used in previous studies in Spain (Varela-Centelles et al., 2019, 2018) and included 24 questions. Fifteen of them were used in this survey to suit the purposes of investigating knowledge about periodontal disease, its aetiology, signs and symptoms as well as its related factors: 3 about socio-demographic features (age, gender and educational level completed: compulsory education (10 years), high school (14 years), vocational training (12–14 years) university degree (17–20 years)), 2 about routines and habits (oral self-care and dental visits), 2 about periodontal status (current bleeding gums when brushing and tooth mobility) and 8 about periodontal health knowledge (heard about periodontitis, aetiology, risk factors, health problems related to PDs, periodontitis signs/symptoms, bleeding when brushing is normal, periodontitis can be treated, periodontitis can be prevented).

The instrument was created and developed in Spanish and Galician languages. In order to confirm the interviewee understood the disease he/she was being asked about, the first question was whether the participant had heard about periodontitis. If the answer was negative, the term pyorrhoea was employed. If the answer was still negative, the volunteer was presented a standardised, general description of periodontitis ("*A disorder defined by inflammation of the gums that destroys the ligaments and the bone supporting the teeth*"). The questionnaire was constructed from the information gathered for a previous critical systematic review on periodontal health knowledge and awareness (Varela-Centelles et al., 2016). The relevant topics from the literature were used to draft a questionnaire which was assessed by a panel of experts for clarity, simplicity, relevance and need for each item (Gholami, Pakdaman, Jafari, & Virtanen, 2014). The resulting instrument was piloted in a group of 5 clinicians, and some items were reformulated, corrected or deleted. This second draft was piloted in a group of 10 undergraduate dental students at the School of Medicine and Dentistry of the University of Santiago de Compostela and 95 senior participants in leisure activities at a community centre of the Lugo city council.

### 2.2 | Participants and setting

Sample size was calculated by quota sampling assuming an accessible population of 5% and an expected percentage of response of 28% (Rogers, Hunter, & Lowe, 2011). This sample size (10,804) enabled a power of 0.92% for estimating the proportion of regular users of dental services, presuming a value of 60%.

Only adults (>18) entered the study. Exclusion criteria were being mentally handicapped or poor command of any of the official languages of the community (Spanish or Galician) in terms of oral communication ability.

### 2.3 | Data collection

The survey was carried out from 1 March 2015 to 30 June 2016 in all four provincial capitals in Galicia (Northwestern Spain), an autonomous region with 2,708,339 inhabitants unevenly distributed in 29,574.4 $Km^2$, whose yearly gross domestic product per capita is 21,358 € and their life expectancy at birth is 82.8 years (Galician Institute for Statistics, 2018).

The interviewers approached prospective participants at four different places of each four province capitals in the region and their metropolitan areas. Data collection was undertaken in different week days and times at each selected location. These places included both administrative zones and a range of commercial streets and shopping centres in a sort of pathfinder survey method (World Health Organization, 2013).

All interviewers participated in a 1-hr long workshop, designed to prevent interviewer-related biases, which included a discussion of each item in the instrument together with the related ethical aspects, as well as a role-playing session where voluntary undergraduate dental students acted as interviewees.

Data from each completed questionnaire were coded and entered into a database. As each form was identified by a single number, an assessment of the process of data coding and mechanisation could be undertaken in 40 randomly selected questionnaires. Data were then transferred to the statistical packages (R v3.3.2, MASS, and nnet) (R Core Team, 2014; Venables & Ripley, 2002).

### 2.4 | Data analysis

Categorical variables were characterised by their plain frequencies and percentages, and continuous ones by their medians and interquartile ranges. Relationships between variables were analysed using chi-square/Fisher's exact tests and the Mann–Whitney U tests.

The total number of correct answers was computed in three different areas: one question about aetiology (0–1 points), six questions about disorders related to periodontitis (0–6 points), another six about risk factors (0–6 points) and the total sum of them (0–13 points). The median of the distributions was chosen as a cut-off point to identify those participants with good (above the median) periodontal health knowledge. A logistic regression analysis was also undertaken to disclose hypothetical relationships between good

periodontal knowledge and frequency of dental visits. ORs with their confidence intervals (CI) at 95% were calculated.

## 3 | RESULTS

A total of 8,206 individuals were invited to enter the study, and 3,553 accepted the invitation (response rate: 43.3%). All questionnaires were included in the analysis.

The first question in the survey was whether the participant had heard about periodontitis/pyorrhoea (yes: 62.1%; *n* = 2,206; no: 37.9%; *n* = 1,347). Volunteers were classified by the frequency of their dental visits as "regular users" (at least once a year) (59.3%; *n* = 1,945) or "inconsistent users" (any other response) (40.7%; *n* = 1,339). The frequency of regular dental visits diminished with age and increased both with periodontal disease familiarity and academic achievements (Table 1). Females predominate among regular dental attenders (65%; $p < .001$); regular users of dental services are also significantly younger, higher educated and less likely to be experiencing periodontitis than their counterparts occasionally visiting their dentist (Table 1).

More than one third (37.9%; *n* = 1,347) of the participants had never heard of periodontitis, and many (54.4%; *n* = 589) fit within the regular dental attenders' group.

**TABLE 1** Mean features of the whole sample by frequency of dental visits

| Variable | *n* | Regular users (1945) | Inconsistent users (1,339) | *p*-value |
|---|---|---|---|---|
| Gender | | | | |
| Male | 1605 (48.9) | 854 (53.2) | 751 (46.8) | <.001 |
| Female | 1678 (51.1) | 1,091 (65.0) | 587 (35.0) | |
| Age | | | | |
| 18–34 | 943 (28.7) | 658 (69.7) | 285 (30.3) | <.001 |
| 35–44 | 652 (19.9) | 412 (63.2) | 240 (36.8) | |
| 45–64 | 971 (29.5) | 555 (57.1) | 416 (42.9) | |
| >64 | 718 (21.9) | 320 (44.5) | 398 (55.4) | |
| Do your gums bleed? | | | | |
| No | 2066 (62.9) | 1,298 (62.8) | 768 (37.2) | <.001 |
| Does not know | 13 (0.4) | 3 (23.0) | 10 (77.0) | |
| No teeth | 25 (0.8) | 1 (4.0) | 24 (96.0) | |
| Yes | 1,180 (35.9) | 643 (54.5) | 537 (45.5) | |
| Do you have any mobile tooth? | | | | |
| No | 2,724 (83.0) | 1698 (62.3) | 1,026 (37.7) | <.001 |
| Does not know | 79 (2.4) | 15 (18.9) | 64 (81.1) | |
| No teeth | 70 (2.2) | 8 (11.4) | 62 (88.6) | |
| Yes | 407 (12.4) | 222 (54.5) | 185 (45.5) | |
| Heard of periodontitis | | | | |
| No | 1,081 (33) | 589 (54.4) | 492 (45.6) | <.001 |
| Yes | 2,203 (67) | 1,356 (61.5) | 847 (38.5) | |
| Smoker | | | | |
| Former | 499 (16) | 249 (49.9) | 250 (50.1) | <.001 |
| No | 1923 (59) | 1,236 (64.2) | 687 (35.8) | |
| Yes | 812 (25) | 438 (53.9) | 374 (46.1) | |
| Educational achievements | | | | |
| Compulsory education | 1,054 (33) | 488 (46.3) | 566 (53.7) | <.001 |
| High School | 987 (30) | 634 (64.2) | 353 (35.8) | |
| Vocational training | 441 (14) | 259 (58.7) | 182 (41.3) | |
| University degree | 749 (23) | 540 (72.1) | 209 (27.9) | |

*Note:* Values in absolute cases and percentages in parentheses.
*p*-value calculated using the chi-square test.

Those familiar with the disease were questioned about different aspects of periodontal health and about their preventive attitudes. In this subset of patients, regular users accounted for 61.5% of the sample ($n$ = 1,356). When asked about the aetiology of periodontitis, few participants (12.4%; $n$ = 272) answered correctly (bacteria), but significant differences could be observed between regular (15.4%; $n$ = 210) and inconsistent (7.3%; $n$ = 62) users of dental services ($p$ < .001). Regular dental attenders recognised health problems related to periodontitis better than the group of inconsistent users (Table 2). When asked to mention at least two symptoms of periodontitis, regular attenders also performed better than their counterparts (42.4% vs 31.4%; $p$ < .001). The same occurred when asked whether they find normal to experience some bleeding when toothbrushing (31.6% vs 44.7%; $p$ < .001).

Regarding periodontal risk factors (Table 2), both hygiene and smoking were well recognised by the sample. Other factors were better recognised by the group of regular users. It is worth mentioning participants attribute bacteria a relevant role in periodontitis, but only as a risk factor, not as an aetiological agent.

When asked about preventive attitudes and beliefs, 90.8% ($n$ = 1,176) regular attenders said periodontitis can be prevented compared with 85.6% ($n$ = 658) of inconsistent users ($p$ < .001). These differences diminish when questioned about whether periodontitis can be treated (89.8% vs 85.9%; $p$ = .008). The same phenomenon occurred with the distribution of non-smoking volunteers in both groups (78.8% vs 72.9%; $p$ = .001).

Participants were also classified by their reported oral self-care routines in two groups: adequate routines (toothbrush and interdental cleaning at least once a day) and inadequate practices (any other response). Although the number of interviewees reporting adequate routines was low, regular attenders consistently reported better habits (14.6% vs 5.9%; $p$ < .001).

Regular dental attenders also elicited better periodontal knowledge than their inconsistent counterparts (Table 2). Logistic regression analysis (Figure 1) showed the chances for having an above-median periodontal health knowledge are almost equally influenced by higher education (OR 1.64; 95% CI: 1.30–2.06) and regular use of dental services (OR 1.67; 95% CI: 1.40–2.00), and negatively conditioned by age (>64: OR 0.68; 95% CI: 0.51–0.90).

In an attempt to further disclose the part of educational achievements in periodontal health knowledge, the group of participants with compulsory education was explored in more detail (Table 3), and inconsistent dental users showed significantly poorer results in all aspects but aetiology of periodontitis.

As participants with higher chances of being experiencing periodontal problems could be more likely to require periodic dental

**TABLE 2** Risk factors and relationship with other health problems

| Topic | Total (2079) | Regular users (1,302) | Inconsistent users (777) | $p$-value |
|---|---|---|---|---|
| In your opinion, periodontitis is linked to* | | | | |
| More chances for another disease | 1,102 (53) | 743 (57.1) | 359 (46.2) | <.001 |
| Tooth loss | 1977 (95.1) | 1,250 (96.0) | 727 (93.5) | .012 |
| Damage to jawbone | 1,650 (79.4) | 1,081 (83.0) | 569 (73.2) | <.001 |
| Heart infarction | 716 (34.4) | 477 (36.6) | 239 (30.7) | .002 |
| Diabetes | 932 (44.8) | 625 (48.0) | 307 (39.5) | <.001 |
| Adverse pregnancy outcomes | 376 (18.1) | 261 (20.1) | 115 (14.8) | <.001 |
| What increases the chances of experiencing PDs?* | | | | |
| Genetics | 1,493 (71.8) | 983 (75.5) | 510 (65.6) | <.001 |
| Hygiene | 2045 (98.4) | 1,286 (98.7) | 759 (97.6) | .068 |
| Smoking | 1929 (92.8) | 1,219 (93.6) | 710 (91.3) | .154 |
| Age | 1,344 (64.6) | 885 (67.9) | 459 (59.0) | <.001 |
| Bacteria | 1689 (81.2) | 1,230 (94.4) | 459 (89.1) | <.001 |
| Diabetes | 1,447 (69.6) | 764 (58.7) | 683 (49.2) | <.001 |
| Overall knowledge score: | | | | |
| Disorders related to periodontitis** | | 3 (2–4) | 3 (2–4) | <.001 |
| Risk factors** | | 5 (4–6) | 5 (4–6) | <.001 |
| Total score** | | 9 (7–10) | 8 (6–9) | <.001 |

Abbreviation: PDs, periodontal diseases.

*Values in absolute cases and percentages in parentheses. $p$-value calculated using the chi-square test.

**Values in medians and interquartile ranges. $p$-value calculated using the Mann–Whitney U test.

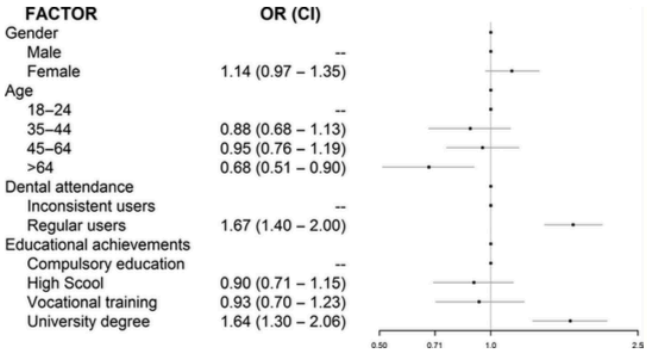


**FIGURE 1** Logistic regression analysis to disclose factors influencing periodontal knowledge

**TABLE 3** Distribution of periodontal knowledge among the "compulsory education" subgroup

| Overall knowledge score | Regular users (302) | Inconsistent users (327) | *p*-value |
|---|---|---|---|
| Aetiology* | 22 (7.3) | 16 (5.1) | 0.247 |
| Disorders related to periodontitis** | 3.08 (1.6) | 2.74 (1.5) | 0.007 |
| Risk factors** | 4.88 (1.3) | 4.45 (1.4) | <0.001 |
| Total score** | 8.06 (2.5) | 7.26 (2.5) | <0.001 |

*Values in absolute cases and percentages in parentheses. *p*-value calculated using the chi-square test.
**Values in means and standard deviations in parentheses. *p*-value calculated using the Student *t* test.

care, volunteers reporting both bleeding gums and tooth mobility were identified. The distribution of these participants by their frequency of dental visits showed no significant differences (7.3% vs 7.7%; $p = .698$). Not all regular dental attenders likely to be experiencing periodontitis were familiar with the disease (51.5%; $n = 73$).

## 4 | DISCUSSION

Regular dental attenders know more about periodontitis than erratic users of dental services. However, our results disclosed that almost one third of regular users of dental services had never heard of periodontitis (Table 1) and also that the other two thirds had significantly better knowledge than inconsistent users about almost every topic of periodontal health. Regression analysis permitted profiling the person with better periodontal knowledge: younger females holding a university degree and regularly attending their dentist.

Traditionally, in industrialised countries, most dental patients receive oral health education/ information in addition to their treatment. Unfortunately, oral health education usually induces short-term improvement in knowledge and limited effects on behavioural and clinical outcomes (Watt, 2005).

Although reports on oral health education in dental clinics are very scarce, the findings disclosed in our survey somehow agree with the reported low frequencies of adult patient recall of oral health education services received in private practice settings (McConaughy, Toevs, & Lukken, 1995). Although health education during dental visits is usually limited by time and frequently addressed to a particular problem (Raidi et al., 2015), systematic and organised efforts in combination with adequate information have proved useful in improving compliance with supportive periodontal therapy in dental clinics (Demirel & Efeodlu, 1995; Wilson et al., 1993).

The largely reported modest practice of patient education in dental offices (Skogedal & Heloe, 1979) seems to be still a current issue (Hughes et al., 2018). Reasons for this low performance include patient resistance, lack of time, lack of reimbursement mechanisms and absence of readily accessible patient education materials (Allard, 2000).

An intriguing question about our results could be the part of education in periodontal health knowledge. In general, the introduction of an extra year of compulsory education resulted on a reduction in self-reported poor health by 4–6 percentage points (Brunello, Fort, Schneeweis, & Winter-Ebmer, 2016). In terms of periodontal health, this extension increased the chances for receiving periodontal treatment when necessary (Grytten & Skau, 2017). Knowledge can be considered a precondition in a series of factors affecting health behaviour (Deinzer, Micheelis, Granrath, & Hoffmann, 2009), and education would increase the individual's stock of skills to make superior and more sensible health choices (Grossman, 2006). The analysis of the subgroup of participants with compulsory education as their highest educational achievement confirmed the positive effect of regular dental attendance in periodontal knowledge.

Another interesting question could be how many participants were experiencing periodontitis, as they may well be better informed about PDs and may attend dental clinics more frequently. We used a poor approximation for advanced periodontitis (reported bleeding gums and tooth mobility) (Airila-Mansson, Söder, Jin, Söder, & Klinge, 2004; Ankkuriniemi & Ainamo, 1997; Blicher, Joshipura, &

Eke, 2005), and no significant differences were found in the distribution of periodontal patients between regular and inconsistent dental attenders. This raises the question of how many of these patients were actually being treated.

A potential weakness of this survey is its uncompleted sample size. In an attempt to quantify the impact of this shortcoming, the precision of the study was recalculated for an infinite population resulting in an actual precision error of 1.42% in the estimation of a proportion by an asymptotic 95% bilateral confidence interval, assuming an expected proportion of 28%. Another matter of concern could be the apparently limited response rate achieved (43.3%), which is within the range reported in studies using a similar approach (28% in the UK (Rogers et al.., 2011) in 2008, 30% in Australia (Campbell et al., 2014) in 2009 or 50% in Hong Kong (Fan et al., 2016) in 2015). Unfortunately, hypothetical socio-demographic differences between respondents and non-respondents could not be explored.

A possible information bias—where the interviewer did not ensure all participants received the same information when questioned—was controlled by selecting motivated and knowledgeable interviewers and also through the previously described workshop. Bias for an "ideal response" was controlled by including in the instrument items requiring the participant to disagree with the interviewer to give a correct answer (Lin, Wong, & Wang, 2001). There is also the possibility for a selection bias, as potential participants with poorer attitudes towards oral health may have refused to participate more frequently than those with positive ones. This conjectural phenomenon may not have necessarily influenced our results, because these participants would probably fit better into the group of inconsistent users and thus not affecting our conclusions.

The use of the median as a cut-off point in the identification of participants with better periodontal health knowledge somehow incorporates the particularities of the sample being studied and offers advantages over the mean—like the limited influence of extreme values—and also over arbitrary points, where each response to each question would have to be weighted according to subjective criteria.

Generalisation of our results may be compromised, but taking into account the size of the analysed sample, the power of the study and the wide range of areas of data collection (gathering approximately 68.6% of the population (Galician Institute for Statistics, 2018) and 68.2% of dental clinics (Galician Health Service, 2017) in the region within a 40' travel from each city) makes us think our results may offer a dependable picture of the actual situation of periodontal health knowledge among regular dental attenders.

The features of the Galician population are not essentially different from those in other parts of Spain with the hypothetical exception of the largest cities, where access to information and dental health care could be different and may (or may not) influence periodontal health knowledge among lay people. Similar results could be expected from Portugal—and maybe from other Southern European countries—because of socio-cultural reasons and similarities in the healthcare system.

Patient education has now established itself as an important part of patient care (Hoving et al., 2010) and patients expect clinicians both to "act as encouraging informers, explorers of everyday life and reflective partners" (Liira, 2011) and to engage in the development of oral health literacy in their communities (Hughes et al., 2018).

Oral health literacy—knowledge on the causes of oral diseases, ability to apply this understanding and to incorporate self-care behaviours, and also to navigate the healthcare system when needed (Holtzman et al., 2017)—is a research priority (National institute of Dental & Craniofacial Research, National Institute of Health, U.S. Public Health Service, Department of Health Human Services, 2005), and it is linked to periodontal attachment levels (Wehmeyer, Corwin, Guthmiller, & Lee, 2014). Sound teaching practices implemented in the dental chair should have an effect on patient oral self-care practices and treatment compliance (Hughes et al., 2018). In this sense, periodontal health campaigns have been addressed to dentists to change their working routines and to improve patient education (Brown, Keily, & Spencer, 1994; Sogaard, 1988). Although these efforts resulted in modest modifications, they are considered an effective way of reaching the public to deliver periodontal messages (Sogaard, 1988), whose impact is frequently underscored because physicians rarely change their clinical practices immediately after becoming aware of an alternative (Lockyer, Parbousingh, Mc Dougall, & Chugh, 1985).

Increasing public's periodontal information is intuitively positive, and strengthening oral health education will lead to improved attendance at scheduled dental check-ups (Sato & Oda, 2011) which, in turn, increases the chances for opportunistic education in dental offices. Psychological interventions have become a matter of interest because of their reported positive effects (Kakudate, Morita, Sugai, & Kawanami, 2009), although a recent systematic review has concluded that the certainty of evidence in support of these approaches is low, and therefore, they not should yet be routinely provided in dental care (Werner et al., 2016). The motivational interview is one of these promising psychological interventions with usually good acceptance by patients, although aspects such as the best number of sessions and their length, together with the level of training required to use it effectively and the optimal timing and targets have not been sufficiently investigated (Randall, 2018).

Lack of knowledge may influence periodontal health inequalities (Jin et al., 2011), and periodontal diseases share modifiable risk factors with a range of chronic systemic disorders (Jürgensen, Petersen, Ogawa, & Matsumoto, 2012). This circumstance offers an opportunity for policymakers and institutions to promote periodontal health knowledge among lay public, which may contribute to reduce the observed gap between regular and occasional dental attenders.

Another issue with oral health promotion is the method of evaluation, which is reported to be poor and in need of further

development (Watt, Fuller, Harnett, Treasure, & Stillman- Lowe, 2001), with the lowest performing measures in the categories of healthy lifestyle and health literacy (Watt et al., 2006). In this sense, our indirect approach to the issue of periodontal health promotion in dental clinics may offer an approximation to the problem and a starting point for further research and interventions on this topic.

## 5 | CONCLUSIONS

Reported regular dental attendance is related to periodontal health knowledge. Specific interventions for promoting tailored patient education on periodontal topics during routine dental visits may have a positive effect on laypersons' knowledge about periodontal health.

### CONFLICT OF INTEREST

None.

### AUTHOR CONTRIBUTIONS

All authors contributed equally to this investigation. Drs Varela-Centelles, Estany-Gestal, Blanco-Hortas, and Seoane-Romero conceived the study and designed the investigation with the collaboration of Drs Diz-Iglesias and Bugarín-González. Data acquisition was coordinated by Drs Diz-Iglesias, Bugarín-González, and Seoane-Romero. Drs Blanco-Hortas, Estany-Gestal, and Varela-Centelles focused on data analysis and interpretarion. The manuscript was drafted by Drs Blanco-Hortas, Estany-Gestal and Varela-Centelles. All authors critically reviewed all drafts of the manuscript and approved its final version.

### ETHICAL CONSIDERATIONS

The research protocol was approved by the Santiago-Lugo Committee on Research Ethics (#2014/600). The investigation was undertaken in full accordance with the Declaration of Helsinki and the Spanish regulations. The results are presented according to the STROBE guidelines (Strengthening The Reporting of OBservational studies in Epidemiology) (Vandenbroucke et al., 2009).

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